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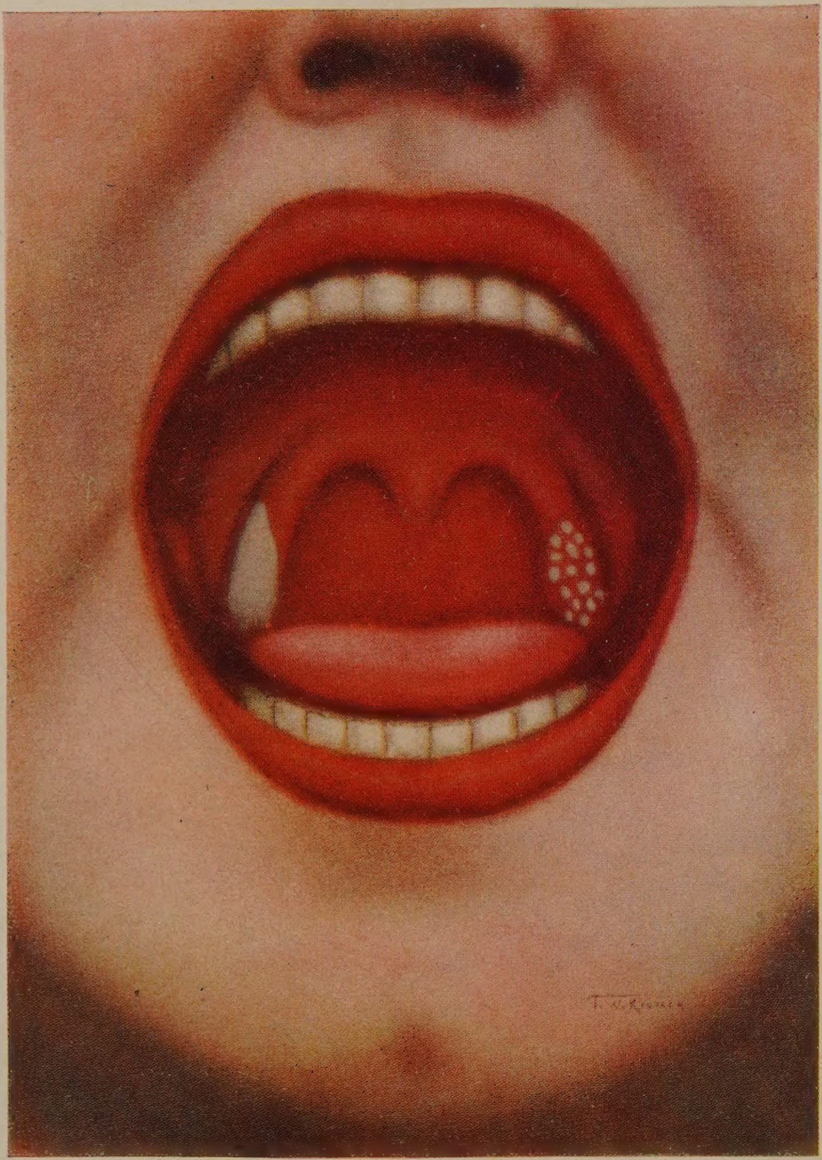
PLATE I



Diphtheria exudate on both tonsils. Follicular type on left tonsil, and membranous type on right tonsil.

DISEASES
OF
INFANCY AND CHILDHOOD
THEIR
DIETETIC, HYGIENIC, AND MEDICAL TREATMENT

A TEXT-BOOK DESIGNED FOR PRACTITIONERS
AND STUDENTS IN MEDICINE.

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BROOKLYN; FELLOW OF THE NEW YORK
ACADEMY OF MEDICINE, ETC.

ELEVENTH REVISED EDITION

VOLUME I
INFANT FEEDING AND ORGANIC DISEASES

*WITH ONE HUNDRED AND FORTY-SIX TEXT ILLUSTRATIONS,
SEVERAL IN COLORS, AND THIRTY-SEVEN FULL-
PAGE HALF-TONE AND COLOR PLATES*

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PRINTED IN U. S. A.
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TO
Dr. WILLIAM H. PARK
AND
Dr. ANNA WILLIAMS
AND THE LATE
Dr. ABRAHAM ZINGHER

THIS BOOK IS MOST AFFECTIONATELY
INSCRIBED AS A TRIBUTE TO THEIR
SCIENTIFIC ENDEAVORS

5501

PREFACE TO ELEVENTH EDITION

Pediatric research has brought to light many new facts since the appearance of my last edition. The clinical advantages of the Ultra-violet Ray, commonly known as Quartz Light, forms an important part of the therapy in malnutrition and rickets. It is especially indicated in the treatment of enlarged tuberculous glands located in the cervical region and also in post-infectious debility. It is also useful in the treatment of various skin diseases and almost specific in pustular eczema as well as multiple furunculosis. The use of anatoxin is described as it is now being used for immunizing children against diphtheria.

An article on Celiac Disease has been added, likewise an important diagnostic aid in differentiating between a suppurative otitis media and a mastoiditis.

Louis Fischer.

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PART I.

Nutrition.

I.

THE ABDOMEN.

The abdomen of a child is comparatively larger than that of an adult. Especial attention should be given to the condition of the abdomen, as it often is a diagnostic aid. For instance, a retracted abdomen is usually seen in meningitis. (See chapter on Meningitis.) A distended abdomen is frequently seen in rachitis (pot-belly). (See article on Rachitis.) A very prominent abdomen is seen in chronic peritonitis, to which I direct attention in the article dealing with this subject.

THE INFANTILE STOMACH.

The infantile stomach is vertical and cylindrical and the fundus but little developed. Thus, whenever there is a tendency to vomit, the antiperistaltic motions do not press against the fundus, but directly upward. There is, therefore, rather an overflow than a vomiting of the gastric contents. This takes place so easily that the infants are not disturbed by it.

Musculature.—The muscular development is weakest at the fundus. According to Fleischmann, the oblique and the longitudinal fibers described by Henle, which have their origin at the pyloric opening, "do not exist in the infant." The investigations of Leo and von Puteren show that, in spite of this lack of muscular development, the stomach of a nursing infant is emptied in one and a half or two hours. With food that is more difficult to digest, the gastric contents are propelled more slowly.

The Mucous Membrane of the Stomach.—The mucous glands are far more numerous on the pars pylorica than in adults, whereas they are far fewer in number at the cardia.

The mucous membrane of the infant secretes gastric juice, which, in general, is similar in properties to that of the adult.

The amount of secretion in the infant is *far less* than in the adult, while its chemical constitution is the same, namely: Pepsin, lab-ferment, and acids. The exact proportion of the ferment and pepsin has not yet been studied sufficiently to admit of any positive deductions being made.

Physiology.—It is very important to know that the mucous membrane of the mouth is practically dry at birth; the secretion of saliva is very small, and, according to Korowin and Zweifel, increases toward the end of the second month.

The fermentative (sugar-splitting) properties of saliva, which is trifling at the commencement, increases with the quantity of the saliva secreted. This is essentially true of other secretions; thus, the pancreatic juice does not have the same emulsifying properties in the infant as in adults.

The nursing or sucking center is located, according to experiments made on animals by Bach, in the medulla oblongata on the inner side of the corpus restiforme.

The sucking act is a reflex according to Auerbach, the muscles of the tongue participating most actively.

Acids in the Infant's Stomach.—The gastric contents in a nursling contain two acids: (1) Hydrochloric acid, (2) lactic acid. The relative acidity is smaller than in adults, the highest point being reached one and a half hours after nursing. According to von Puteren, the acidity is two and one-half to three times as small as in the stomach of adults. According to Leo, the acidity of the gastric juice of nurslings one and one-half hours after drinking is only 0.13 per cent., whereas, in the adult, after the same time, the acidity is from 1.5 to 3.2 per cent. According to Wohlmann, free HCl can be found in healthy nurslings from one and one-fourth to two hours after taking food. The percentage of free HCl ranges from 0.83 to 1.8 per cent.

Lactic Acid.—The quantity of lactic acid is, according to Heubner, between 0.1 and 0.4 per cent.

Pepsin and Hydrochloric Acid.—There are two chief functions of the pepsin and hydrochloric acid which are the same in both infant and adult: First, the power of killing bacteria: A real bactericidal power. Second, as a solvent for albumin. Thus, it is apparent that pathogenic micro-organisms that might have entered the stomach can be destroyed, although we know the small quantity of acid is hardly able to cope with large quantities of food contaminated with bacteria.

Unorganized Ferments.—The unorganized ferments seem to be nitrogenous bodies; their exact composition is unknown, and it is doubtful if they have ever been obtained perfectly pure (Landois and Stirling).

Action of the Saliva on Various Bacteria.—Triolo describes a series of interesting experiments with saliva. He first irrigated the mouth with bichloride or permanganate of potash solution, followed this by irrigation with sterilized water until the disinfecting substances were removed, and then inoculated the surface of various culture-media with the sputum. His results proved that saliva possesses a distinct bactericidal property, for cultures of five-day-old bacteria were destroyed, as well as fresh bacteria eighteen hours old.

This property, however, was lost when saliva was filtered. The saliva of the parotid and submaxillary glands, taken singly, were equally efficacious as their combined secretion. He believes that the greatest bactericidal action is due to the secretion of the mucous glands in the mouth.

The Influence of Gastric Juice on Pathogenic Germs.—Gastric juice is, according to the experiments of Kurlow and Wagner, an exceedingly strong germicidal agent, and when living bacilli get into the intestinal canal it is due to various conditions entirely independent of the gastric juice. When the latter is normal and in full activity, only the most prolific microbes—such as tubercle bacilli, the bacilli of anthrax, and perhaps the staphylococci—escape its destructive action; all others are destroyed in less than half an hour. Similar influences exist in the intestines, as proved by inoculation with the cholera bacilli.

Judging from the results of experiments made by Zagari, Straus, and Wurtz, who exposed various pathogenic organisms, among others that of tuberculosis, to the action of gastric juice, we must come to the conclusion that, so long as the gastric juice retains a sufficient degree of acidity, tuberculosis of the alimentary canal will be unlikely to occur.

Albumin and the Gastric Juice.—Another property of gastric juice in infants is the transformation of albumin in the following manner: (1) Syntonin or acid albumin; (2) then albumoses or proteoses; (3) lastly peptone. It is thus apparent that, although the infantile stomach plays a subordinate rôle as a nourishing organ, it cannot be denied that fluid substances—like water, a solution of salt, and solution of sugar—are absorbed. The experiments of von Mering and Brandl indicate that while absorption of sugars takes place to a slight extent, the absorption is not marked unless the solution has a concentration of 5 per cent. Recent experiments point to a non-absorption of proteins from the stomach. The relative size and capacity of the stomach prevent the function from being as thoroughly developed as in the adult.

TABLE No.1.—SHOWING THE UNORGANIZED FERMENTS PRESENT IN THE BODY AND THEIR ACTIONS.

Fluid or Tissues.	Ferment.	Actions.
Saliva	Ptyalin	Converts starch chiefly into maltose.
Gastric juice ..	1. Pepsin	Converts proteins into peptones and proteoses in an acid medium.
	2. Milk-curdling (rennin).	Curdles casein of milk.
	3. Lactic-acid ferment	Splits up milk sugar into lactic acid.
	4. Fat-splitting	Splits up fats into glycerine and fatty acids.
Pancreatic juice	1. Diastasic, or amylopsin.	Converts starch chiefly into maltose.
	2. Trypsin	Changes protein into peptones and amino acids.
	3. Emulsive(?)	Emulsifies fat.
	4. Fat-splitting or steapsin	Splits fat into glycerine and fatty acids.
	5. Milk-curdling	Curdles casein of milk.
Intestinal juice	1. Diastasic	Does not form maltose, but maltose is changed into glucose.
	2. Proteolytic (erepsin) ...	Proteoses and peptones changed to amino acids.
	3. Invertase	Changes sucrose (cane sugar) to dextrose and levulose.
	4. Lactase	Changes lactose to dextrose and galactose.
	5. Maltase	Changes maltose to dextrin and dextrose.
	6. Milk-curdling	In small intestine(?)
	7. Entero-kinase	Activates pancreatic juice.

STOMACH CAPACITY.

At birth the infant's stomach has a capacity of from 9 to 11 drams, or 35 to 43 cubic centimeters. At the end of one month it is increased to 2 ounces, or 60 cubic centimeters.

At the end of three months the gastric capacity is about four times the amount at birth. The very rapid increase from birth to this time soon ceases, and the stomach capacity grows in size, but at a much slower rate of development.

The series of experiments at the Children's Hospital of Petrograd, made by Ssnitkin, showed that the weight, and not the age, determined the capacity of the stomach, and should be used as a guide for the quantity of infant food required.

The actual capacity of the stomach *post mortem* may be found to be 2, 3, or 8 ounces. This does not signify, however, that during life the infant should receive no more than such quantity at a feeding. Careful studies with x-ray and barium show that during the feeding process the stomach begins to empty itself into the duodenum, therefore, an infant may take 4 or even 5 ounces at a feeding, while the actual capacity of the stomach is but one-half that amount.

Biedert also regards the body weight as an important factor in determining the amount of milk to be given. Baginsky maintains that, while this rule will hold good for a great many infants, he must insist upon relying upon the *scales* to show just how much nutriment has been digested, and thus a regular system of weighing, plus the inspection of the stools, will aid in establishing the quantity of food necessary. "There is no unanimity among experienced clinical observers upon the subject of infant-feeding." The majority of clinicians the world over order cows' milk in varying dilutions. Some use the cereals—like wheat, barley, rice, and farina—to dilute and subdivide the curd. Other clinical observers—Budin and Variot, French observers—*advise giving infants, at birth, whole milk; that is, pure, undiluted cows' milk.*

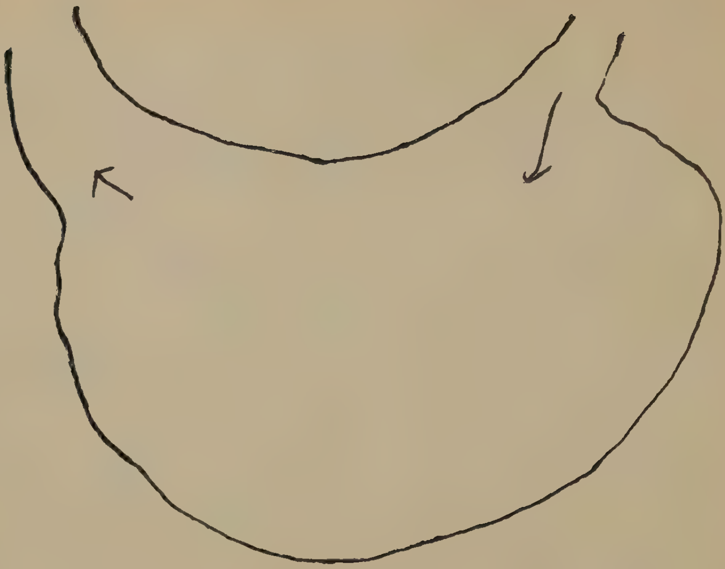


Fig. 1.—Infant's stomach, actual size. From a case of malnutrition. Capacity about 2 ounces. When stomach was filled it held 4 ounces easily. (Author's collection.)

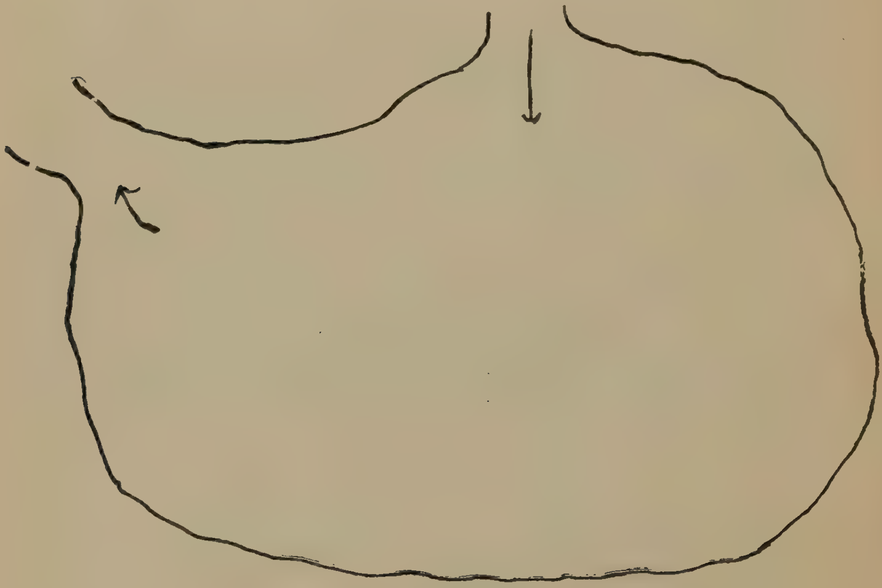


Fig. 2.—Infant's stomach, actual size. Died suddenly from convulsions. Age seven months. Cause of death, eclampsia. Capacity when filled with water 8¾ ounces. (Drawn from specimen in author's collection.)

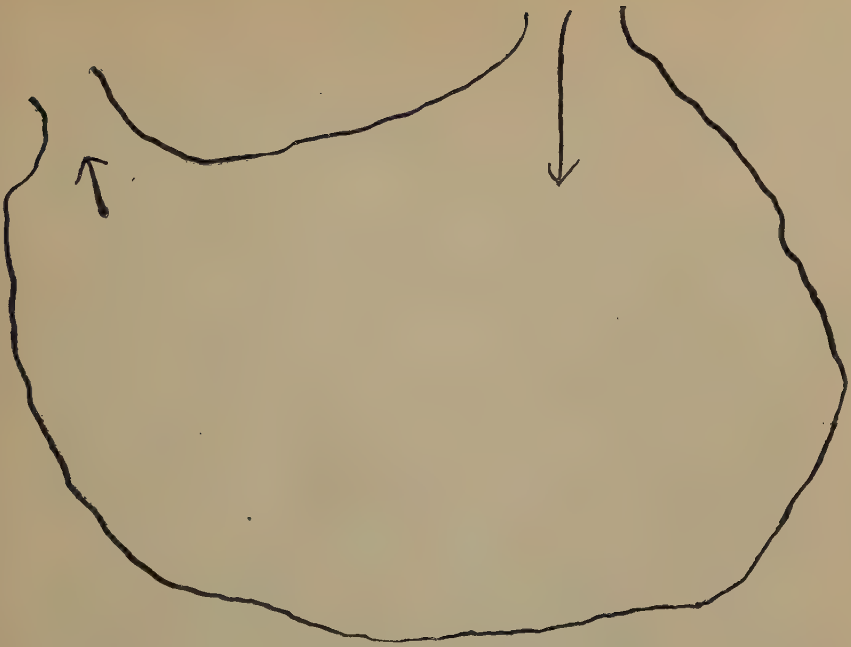


Fig. 3.—Infant's stomach. Capacity, 10 ounces. Age of child, eleven months. Cause of death, enteritis. (Drawn from specimen in author's collection.)

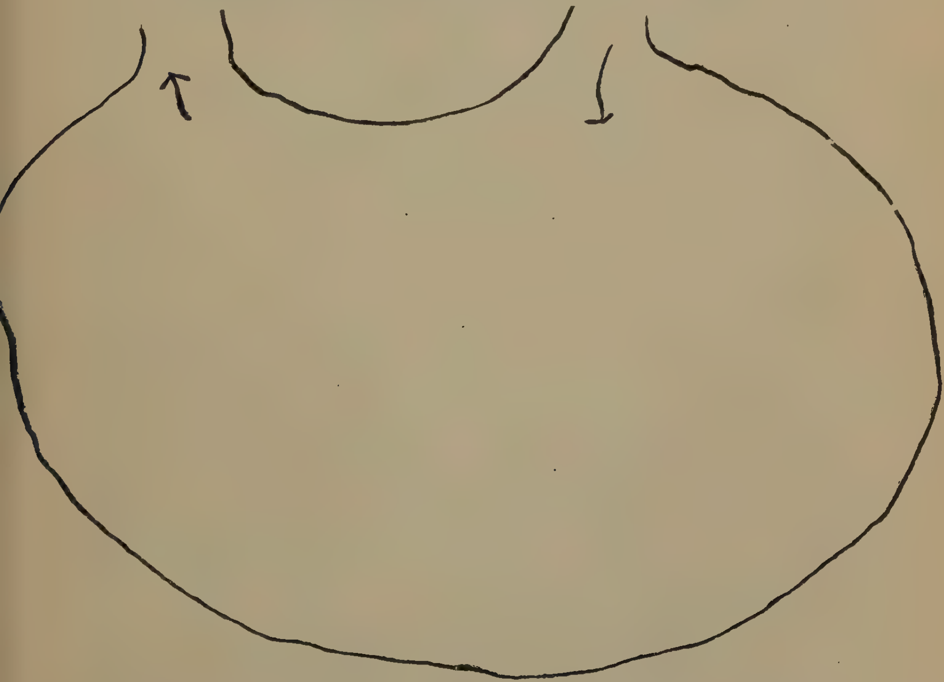


Fig. 4.—Capacity of measurement, 14 ounces. Diseased condition. Normal capacity. Holding about 2 ounces, or 50 cubic centimeters. (Author's collection.)

II.

THE INTESTINES.

Small Intestine.—At birth the length of the small intestine is 9½ feet. The length of the intestine, may, however, vary with the size of the child. In the duodenum Brunner's glands are found. Below the duodenum Peyer's patches are found. The most important physiological function of the small intestine consists in the assimilation of food aided by the action of the pancreatic juice and other secretions. The emulsification of the fat in the food takes place in the small intestine.

Length of the Intestine.—The relative length of the intestine in nurslings is greater than in adults, so that the intestines are six times as long as the body. Forster believes this is one reason why nurslings receive more nourishment from milk than do adults. The small intestine develops during the first two months of life more than the large intestine, and after the second month the reverse is true. The duodenum remains relatively the longer until the end of the fourth month. The transverse colon is the widest and most elastic portion of the large intestine. The continuation of the large intestine in infants, into the rectum, is indicated by a narrowing at this point.

Large Intestine.—According to Treves, the large intestine measures :—

At birth	1 foot 10 inches, or	55 centimeters.
At 12 months	2 feet 6 inches, or	76 centimeters.
At 6 years	3 feet, or	91.5 centimeters.
At 13 years	3 feet 6 inches, or	107 centimeters.

Course of the Colon.—From the right iliac fossa up to the liver, then transversely across the abdomen to the spleen and then downward, terminating in the rectum. The colon forms at its first turn the hepatic flexure, at the spleen the splenic flexure, and finally the sigmoid flexure. The curve of the sigmoid flexure occurs in the left iliac fossa.

Sigmoid Flexure.—The anatomical illustrations of the sigmoid flexure (see article on Chronic Constipation) are important to remember in view of the mechanical cause of constipation so frequently seen in young children.

The transverse colon, when distended with gas, is very easily mapped out by percussion.

The Cecum.—Dwight found the cecum completely covered with the peritoneum in 33 out of 37 cases in young children. Treves states that in 100 cases observed by him he found the peritoneum infolding the cecum, in all of these cases on its posterior surface.

The cecum occupies a higher position anatomically in a child than in adult life.

Vermiform Appendix.—Behind the cecum lies the vermiform appendix. It is important to remember that it lies in the line *midway between the umbilicus and the crest of the ilium.* When the appendix is inflamed and swollen it can frequently be mapped out by rectoabdominal (bimanual) palpation.

Formation of Gas in the Intestine.—When we consider the lesser development of the muscles of the intestine, we can readily understand that peristaltic movements are more irregular and less forcible, and that the muscles possess less tone; on this account *there is a larger amount of gas contained in the intestine. which constantly distends it.* Thus it is apparent why the abdomen always appears larger in the infant in proportion to the other parts of the body.

Action of Intestinal Muscles.—The action of the intestinal muscles is chiefly to transport the food by a series of peristaltic movements. Parts of the intestine are active, while others remain passive. Heubner maintains that post-mortem examinations never show all parts of the intestine in the same condition, owing to the irregularity of the muscular movements.

Development of Glandular System.—The development of the glandular system in infants is very poor, whereas the *lymphoid tissues and follicles are comparatively well developed.*

Lieberkühn's glands are fewer in number than in adults, whereas the Brunner glands in the duodenum are numerous and well developed.

Absorption of Fat.—The absorption of fat takes place through the intestinal epithelium in the duodenum and jejunum. According to the histological investigations by Baginsky, the real absorbing system of the intestinal wall is found in the connective-tissue bodies of the mucous membrane of the infantile intestine, in which are located lymphatic vessels connected with the larger lymph channels of the intestine. The physiological and chemical functions are much less developed in infants than in adults, because the intestinal glands are relatively less developed.

BACTERIA OF THE INTESTINES.

There are a great many bacteria found in the intestines. These are present in a normal infant, as well as in an infant suffering from a gastrointestinal disorder. A great many of these bacteria are, therefore, non-pathogenic. Miller, who carefully studied the various micro-organisms in the mouth, found that most of them could again be found in the intestinal canal.

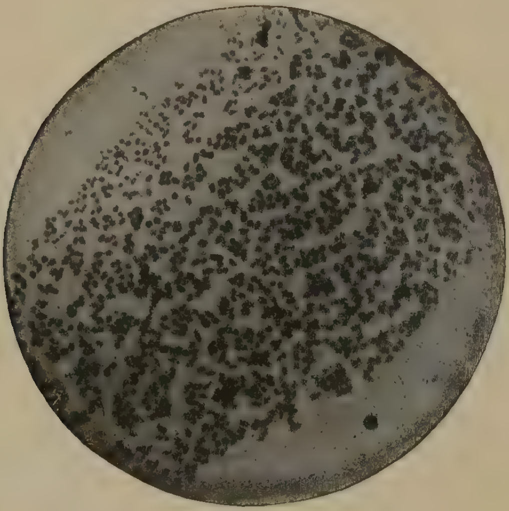


Fig. 5.—Bacterium coli communis.

Moro describes the bacillus acidophilus, which is a constant inhabitant in both the small and large intestines. It has the property of coagulating cows' milk, but not human milk. The bacillus bifidus communis will chiefly be found in the intestine of a breast-fed infant. It is anaërobic. The bacillus coli communis and bacillus lactis aërogenes are largely concerned in the formation of lactic acid. The colon bacillus generates indol as well. The rôle played by bacteria is not yet well understood. It is quite possible that, instead of doing harm, some bacteria do good. When all bacteria are destroyed by sterilization, and bacteria-free milk is fed, scurvy may result.

III.

INFANT STOOLS.

Meconium.—The first discharge from an infant's bowels is called meconium. It has a greenish-brown color; at times it resembles ink in color. It is composed of epithelial cells, bile, cholesterin crystals, and partly digested amniotic fluid. Meconium has no odor. It is usually acid in reaction. The color of the infant's stool changes after a few days of maternal or bottle feeding.

As soon as the exclusive milk diet is changed to the mixed diet we then lose the characteristic infantile stool, and it resembles more that of an adult, though remaining softer and thinner throughout infancy. The stools become darker in color, assume the adult odor, and have more varieties of bacteria than those found in the stool of a milk diet.

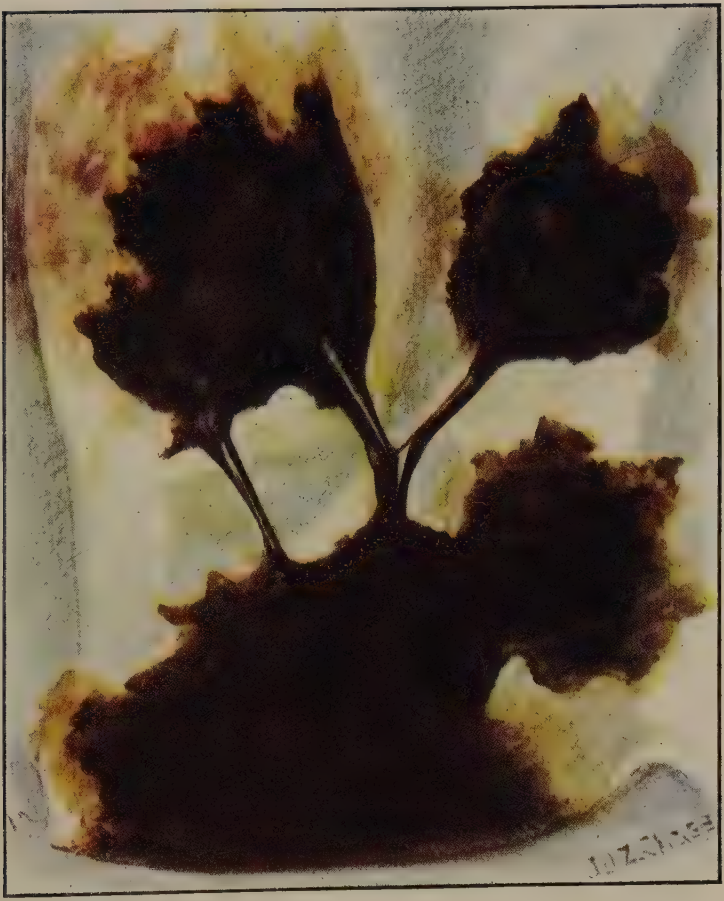
A new conception of the various food elements shows that the opinion of ten years ago regarding the dangers of high fat has been modified, and the possibility of a protein or casein element being the disturbing factor suggested. Modern science has proven beyond a doubt that one reason why the fat element or casein disagrees is due to the presence of *milk sugar;* hence we today regard the *carbohydrate and salt* as the disturbing element in many cases, rather than the fat or casein.

Finkelstein, of Berlin, has proven that in atrophic and marasmic infants in which there is a constant decomposition associated with fever and undigested stools we can modify the nutrition and restore faulty metabolism by omitting the addition of sugar or salt. The most important point, however, to be considered, is that we can feed a very large fat and protein food, such as casein milk.

The stool of a nursling or an infant on a human breast should be yellowish in color, smeary or pasty-like in consistency, and have an acid reaction. Normal yellow stool of a breast-fed infant contains bilirubin. Hydrobilirubin is associated with bilirubin after several weeks.

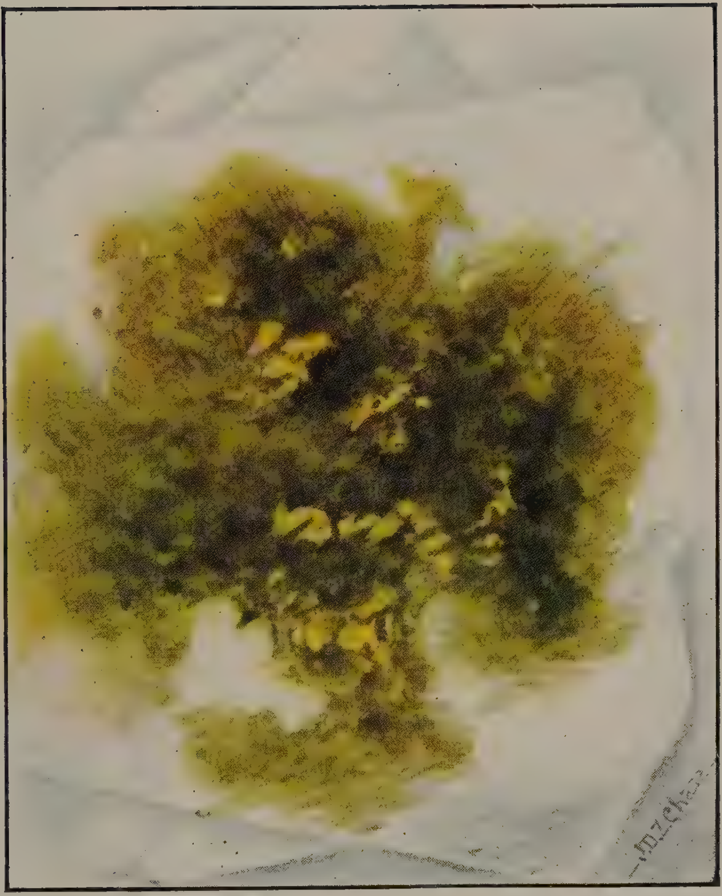
Not infrequently during the first three months, normal infants fed exclusively at the human breast will have several stools

PLATE II



Meconium. (From *Lowenburg:* "Infant Feeding and Allied Topics." Copyright, F. A. Davis Company, Philadelphia.)

PLATE III



Stool of dyspepsia. Occurs in both the breast-fed and bottle-fed baby. In the former its significance can often be disregarded, if the weight remains unimpaired, or the mother's diet may be regulated. In the bottle-fed, institute a hunger period for twenty-four hours. Then reduce the fat and the sugar in the formula, and at the same time administer the protein mechanically and chemically modified. (From *Lowenburg:* "Infant Feeding and Allied Topics." Copyright F. A. Davis Company, Philadelphia.)

a day. They may be green, watery, contain mucus, or appear lumpy. Such infants thrive, gain in weight, sleep well, and are apparently healthy. The cause of such peculiar stool has not yet been determined. They may be caused by maternal influences. Such stools are more frequent whilst the mother is menstruating. These stools should by no means be regarded as due to a pathological condition, for often this condition will regulate itself. Even though greenish stools persist for several weeks, by no means should we change the food, but continue the breast if at all possible for the first three months.

In no branch of pediatrics has so much progress been made in recent years as in the study and interpretation of infant feces. The more we study infantile metabolism, the more we find that an intimate relationship between digestive secretions, on the one hand, and properly modified food, on the other hand, must exist.

Modern views concerning the nature of curds in the stool have decidedly changed since the studies of Czerny and Keller. What formerly was believed to be casein curds is now proven by chemical analysis to consist principally of fat, but there are large, tough curds which are composed of casein in which fat is intermingled. The small, soft curds, however, some of them lentil-shaped or resembling round or flattened particles of compressed butter, consist chiefly of fatty acids and calcium soap in addition to a low percentage of protein.

Talbot describes a simple test which will easily differentiate a casein curd from a fat curd, by simply placing the supposed curd in 10 per cent. formalin and allowing it to stand from four to six hours. If casein the curd will harden; if fat it will become soft.

Langstein,[1] speaking of the white feces, regards the same as due to a faulty assimilation and signifies the beginning of a disturbance of metabolism. Thus, such white feces may be due to a deficiency of the biliary secretion, but there also may be a disturbance in the intestine. Czerny and Keller regard the cause of the white feces as due to the presence of calcium soap.

Jaffé, Gerhardt, and Zoja in a series of examinations have shown that, when urobilin and bilirubin are absent, the derivatives of the bile-pigments, such as urobilinogen, may be present.

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[1] LANGSTEIN: Salkowski's Festschrift, 1904.

This latter substance is a reduction product of urobilin. Urobilinogen is constantly noted in alkaline solutions, but is transformed into urobilin in an acid solution.

Normal and healthy children, such as those fed on human milk, give a negative urobilinogen reaction in the urine. On the other hand, artificially fed infants give a strong urobilinogen reaction in the urine. The reaction is very strong in cases of occlusion of the common bile-ducts, so that this reaction is of very great service in the differentiation of duodenal catarrh in infancy.

One of the reasons for the presence of the large curds is the absence of hydrochloric acid, which acid when entering the duodenum stimulates the flow of pancreatic juice.[1]

Reaction of Stools.—Reaction of stools in diarrheal disease and in health is chiefly acid, or, next in frequency, neutral. Alkaline stools are rare. Grass-green stools, usually acid, are seen in the early stage of dyspeptic diarrhea. The color varies from a pale greenish yellow to grass green, owing to improper food.

The reaction depends on the presence of lactic acid, the source of which is the milk sugar. The only gases present are H_2 and CO_2. According to Escherich, H_2S and CH_4, to which the odor of adult stool is due, are not present. Peptone exists in trifling amount. Sugar is not present. Pancreatic ferment is absent. Sometimes traces of pepsin are found. Mucus is always present in considerable quantity; also columnar intestinal epithelium.

In the stool of nurslings large quantities of lactate of lime can be found; so also we frequently find oxalate of lime, depending on the quantity of oxalate of lime ingested. Ufflemann has noted the presence of bilirubin crystals in the stools of nurslings in perfect health.

Quantity of Feces.—The quantity of feces varies, but it has been found that 100 grams of milk food will produce about 3 grams of feces, according to Baginsky.

Green Stools.—The green color of stool is caused by an abnormal oxidation of bile-pigment in which bilirubin is changed into biliverdin by means of an oxidase.

Typical green stools can be produced by giving an infant 2 or 3 grains of bicarbonate of soda for a few days. This explains

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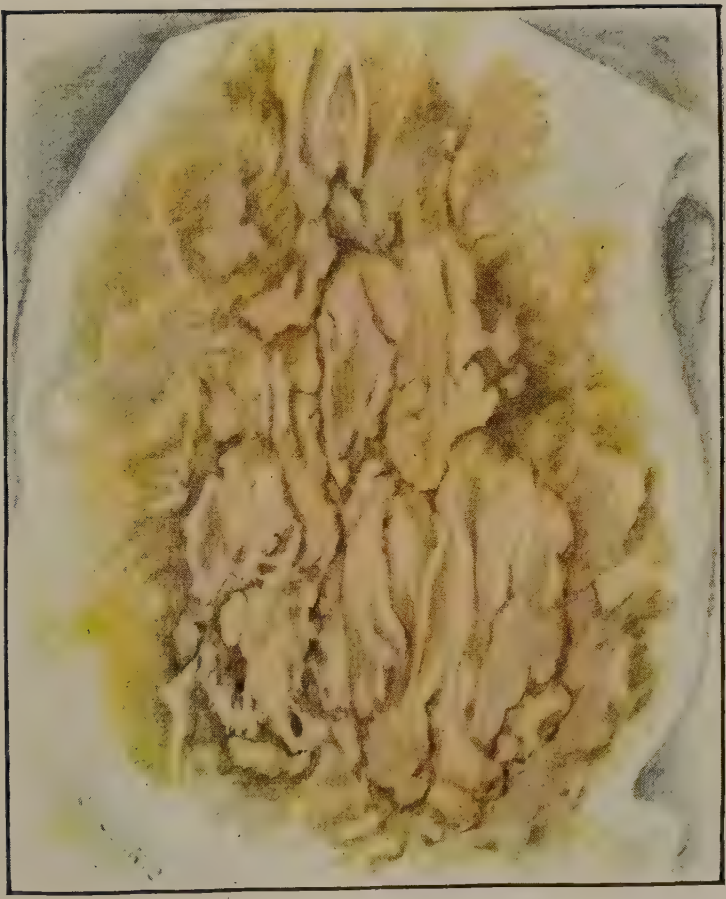
[1] Fisher: "Physiology of Alimentation," 1907.

PLATE IV



Constipated, greasy stool of artificially fed infant. This stool is due to the administration of too much fat. It is foul-smelling (like Limburger cheese), and is commonly accompanied by a stationary weight and an ammoniacal urine. Reduce or omit the fat in the formula or practice the other methods for treating fat intolerance. (From *Lowenburg:* "Infant Feeding and Allied Topics." Copyright, F A. Davis Company, Philadelphia.)

Pfeiffer's alkaline theory. Typical green stools can also be produced by giving small or large doses of calomel. If, after having given bicarbonate of soda and produced green stools, we give diluted hydrochloric acid in 5 to 10 drop doses, the yellow color will reappear in a few days. Rhubarb will also produce a yellow stool.

Stools which are pale yellow when discharged, and which afterward become green, are often seen in disease. They may be themselves neutral or alkaline in reaction; this latter may, however, depend on the admixture of urine. An excess of bile may often cause very green stools.

Wegscheider has shown that the green color is the result of preformed biliverdin. The condition in the intestine, upon which the transformation of bilirubin into biliverdin depends, has been generally regarded as one of acid fermentation.

Pfeiffer's experiments[1] show this former opinion to be wrong. He found that none of the acids formed in such fermentation—lactic, acetic, butyric, propionic, etc.—added to yellow stools outside the body turned them green, but that they made them deeper yellow. But dilute alkaline solutions added to fresh yellow stools turned them green after an exposure of thirty to sixty minutes, and strong solutions turned them, first, brown; later, after exposure to air, intense green.

Casein in high and low percentages has decided therapeutic properties. It increases the intestinal secretion which amounts to about one quart daily. It has an alkaline reaction; hence acts antagonistic to pathological acidity and thereby arrests fermentation. It is possible therefore to modify intestinal fermentation associated with putrefactive stools by omitting sugar and salt, reducing the fat, but chiefly by increasing the casein.

When milk sugar is added in large quantities to food, it results in a primary irritation of the epithelium of the intestine, resulting in acid fermentation, and this latter prevents new epithelium from forming. When this carbohydrate element (milk sugar) is reduced the symptoms are immediately modified, and when the milk sugar is discontinued the casein lumps quickly disappear from the stool; in addition thereto the stool assumes a more solid consistency.

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[1] "Verdauung im Säuglings-alter bei Krankhaften-Zuständen," Jahrbuch für Kinderheilkunde, B. 28, page 164.

Casein Masses or White Curds.—The coarser lumps of casein or so-called casein curds will be described later on. The small casein curds consist chiefly of fat. Casein is not nearly as common an ingredient of feces as is supposed. As far back as 1878 Widerhofer doubted that these masses were really casein, but believed them to be fat with epithelial remains. Adler maintains that it is wrong to call a substance casein because it responds to heat, biuret, Heller, and other protein reactions.

Casein masses or casein lumps are frequently found in infants whose intestinal tract had been thoroughly emptied, and where the diet consisted of whey. It is well known that the casein masses consist chiefly of undigested remains of casein together with fatty acids and alkalies (Selter). The nucleoproteins of the intestinal secretion and the nucleoalbumins of the bile give a similar reaction. When milk has been withheld for a number of days watery discharges in enterocolitis will also give a positive protein reaction in the stool, due to casein masses. The principle of buttermilk feeding lies in the transformation of the casein into casein lactate.

When milk is deprived of fat and casein, the result is whey, and if this whey is fed to an infant we frequently have casein curds in the stool.

Intestinal experiments at Finkelstein's clinic, reported by Meyer and Leopold, show that when the food contains a higher percentage of sugar than the infant can assimilate the result will be casein masses in the stool. That this view is correct is proven by the fact that the moment the sugar element is reduced casein particles gradually disappear. This fact will be still more impressed when we note that with the *reduction of the sugar* we can increase the percentage of casein, thus showing a higher tolerance for casein, after we reduce the carbohydrate element.

Protein.—The protein of milk is so thoroughly absorbed that only small traces of it can be found in the feces.

Albuminous decomposition and its products—tyrosin, indol, phenol, and skatol—are not found in milk feces. Lactic acid, acetic acid, formic acid, and other fatty acids are present, causing the acid reaction. Von Jaksch found a saccharine ferment in the feces of children. Baginsky found a peptonizing ferment also in infantile feces. Escherich[1] says: "If albuminous decomposition with very foul offensive stools exists, albumins should be withheld from the diet and carbohydrates, such as dextrine foods, sugar, and milk, given. If acid fermentation is present with sour, but not offensive stools, carbohydrates are to be withheld and an albuminous food such as animal broths, bouillon, peptones, etc., given. In the decomposition of milk, the sugar of milk, and not the casein, is usually broken up."

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[1] Jahrbuch für Kinderheilkunde, "Beiträge zur Antiseptischen Behandlungsmethode der Magen-Darmkrankheiten des Säuglingsalters."

Sugar.—If the sugar is too low, the gain in weight is apt to be slower than when furnished in proper amount. The symptoms indicating an excess of sugar are: Colic or thin, green, very acid stools, sometimes causing irritation of the buttocks; sometimes there is regurgitation of food and also eructation of gas.

Artificially fed children excrete hydrobilirubin constantly. Whitish stools are usually associated with atony, also with various types of mild dyspepsia. In dyspeptic stools we are apt to find undigested casein or saponified fats. Scrambled egg stools frequently contain small particles of undigested casein and fat.

Fat Diarrhea.—This condition is primarily due to an imperfect function of the bile as well as to the abnormal state of the pancreatic secretion. In such conditions as tuberculosis of the mesenteric glands and in severe enteric catarrh we are apt to find very fatty stools. According to Biedert and Demme, who have devoted considerable study to this subject, in some children the feces showed 50 to 60 per cent. of fat, whereas the normal percentage in ordinary feces varied from 14 to 25 per cent. (which is the normal quantity, according to Ufflemann).

Excess of fat is indicated by the frequent regurgitation of food in small quantities, usually one or two hours after feeding. Sometimes an excess of fat causes very frequent stools nearly normal in appearance. In some cases the stools contain small, round lumps somewhat resembling casein, but really masses of fat.

Blood in Stools.—Blood from the stomach or small intestine frequently gives the stool a black color resembling tar. Thus, a practical point in Boas's "Diagnostik der Magen- und Darmkrankheiten" is that, the brighter the color of the blood, the lower down near the rectum and anus must the pathological lesion be looked for; the darker the blood, the higher up must the cause be sought; *e.g.,* the diseased condition exists in the stomach, duodenum, or jejunum, etc., if the stool contains black blood. If the corpuscular elements of the blood are wanting, then only the presence of blood can be positively diagnosticated by either a microchemical examination or by means of the spectroscope. The presence of red blood-corpuscles must always be regarded as a pathological factor.

Brown Stools, Muddy Stools.—A brown stool in an infant is frequently caused by a diet of animal food or by a diet principally of broth. These stools have no distinct consistency nor reaction. In dyspeptic diarrhea or in some forms of enterocolitis we have very offensive stools and in appearance they resemble muddy water; with the latter there is considerable flatus during each movement.

Brown stools may be due to changed biliary pigment and to drugs: *e.g.,* bismuth causes the well-known dark stool. So also tannic acid and all iron salts give the dark stool, which varies from a deep brown to a black color.

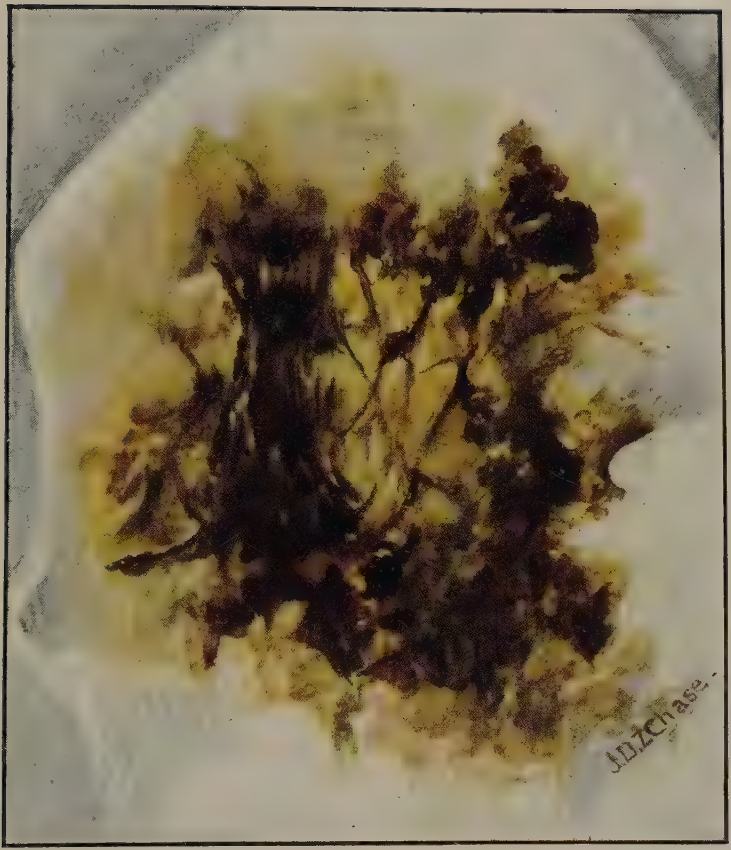
Mucus.—Mucus is always present in all healthy stools and is so well mixed with the stool that it does not appear as mucus to the naked eye. Any appearance, therefore, of mucus easily visible should be regarded as abnormal. Mucus is present in every form of intestinal disease: Very abundant in inflammatory conditions affecting the large intestine, more so than in those affections of the small intestine, and especially so in inflammatory conditions of the colon, both acute and chronic.

Jelly-like masses or shreds of mucus, and cases where the stool consists chiefly of mucus, show that the affection is confined to the lower portion of the colon or that it is located in the rectum.

Long shreds of mucus, frequently resembling false membrane, are often found in catarrh of the large intestine. If the shreds of mucus are intimately mixed with the stool, then we must look for the lesion quite high up, and if it comes from the small intestine it is usually stained from bile. If the lesion is low down the mucus is not intimately mingled with the stool.

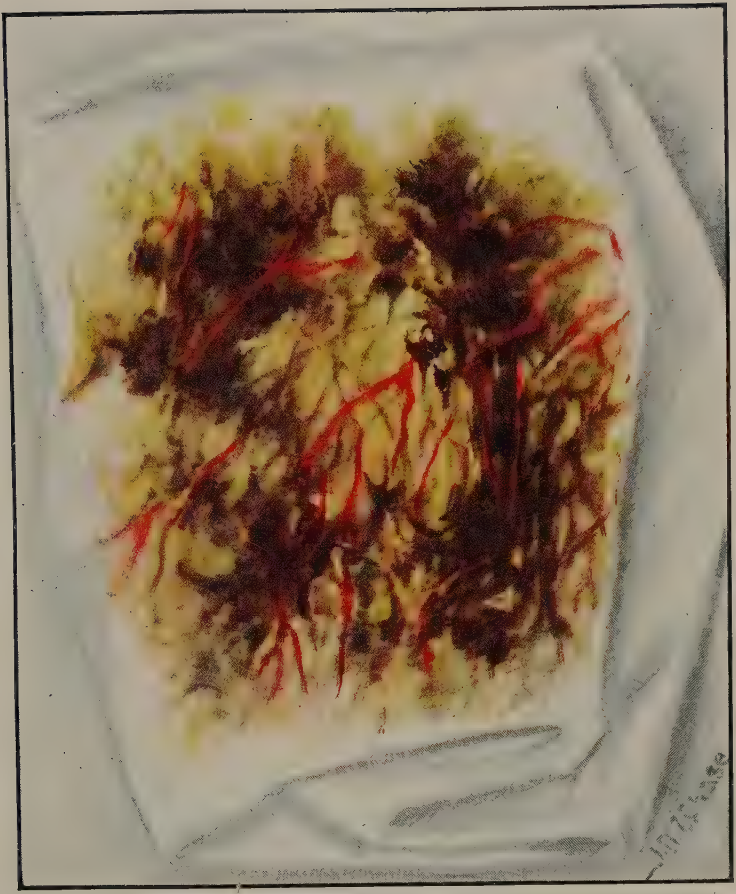
White or Light-gray Stools.—These stools usually are of a putty-like consistency, sometimes like dry balls on a diaper; sometimes they appear like ashes. Usually they are very offensive, consisting principally of fat. There is scarcely a trace of bile, or the latter may be absent altogether.

PLATE V



Stool of a case of diarrhea discolored by bismuth. Notice absence of fecal matter and the excess of mucus. Artificially fed baby; stool commonly seen in intoxication. (From *Lowenburg:* "Infant Feeding and Allied Topics." Copyright, F. A. Davis Company, Philadelphia.)

PLATE VI



Same case as Plate V. Diarrhea more advanced. Note blood and mucus; some green and discoloration by bismuth. Very little milk feces present. (From *Lowenburg:* "Infant Feeding and Allied Topics." Copyright, F. A. Davis Company, Philadelphia.)

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Scybalous Stools.—These are hard, dry, usually round masses in which the intestinal lubricant is absent. These stools are usually accompanied by flatulence. From their stagnation in the colon the gas bacteria cause a chronic distention and enlargement of the abdomen.

Dyspeptic Stool.—The first change noticed in the dyspeptic stool is the increase of fat. Often the stool is quite green and contains small pieces, of yellowish-white color, which vary in size from that of a pinhead to the size of an ordinary pea. Hitherto, from their color, they were supposed to ~~be~~ casein lumps. Wegscheider has taught us that they consist principally of fat. Baginsky has shown that large colonies of bacteria are contained in these lumps of fat. Frequently they are so numerous that it looks as though the stool were composed only of these cheesy lumps. They can be easily differentiated from real casein lumps by their solubility in alcohol and ether.

IV.

PREMATURE INFANTS.

An infant born before 280 days of intrauterine life is called premature. If the length of the body is less than 19 inches we may suspect prematurity.

Prenatal condition in each premature infant must be thoroughly understood before attempting to map out a plan of treatment. We must learn why the infant was prematurely born. Is there a syphilitic ancestor or is there any other inherited weakness which might be responsible for this premature birth? Is the father or mother tuberculous? Has any psychic disturbance or shock to the mother disturbed uterine gestation and precipitated labor? An unfortunate instance of this kind was seen by me recently where a mother was committed to the Manhattan State Hospital for the insane, shortly thereafter giving birth to her infant.

Because of a previous Cesarean section a woman was advised to have the seventh month of pregnancy interrupted, and labor was accordingly induced. The infant prematurely born weighed but 4 pounds. Such factors have an important bearing on the future life of the infant. Prenatal disturbances and prenatal diseases should never be omitted from the clinical history.

Organic diseases in the infant, such as congenital heart disease (blue baby), will greatly influence the development of the infant and likewise aid in determining the prognosis, knowing as we do, the fatality of congenital cardiac lesions.

Premature infants always have a subnormal temperature. The range is usually between 94° and 97° F., hence it is imperative that heat in some form should be provided. A subnormal temperature with poor circulation requires warmth. Our experience shows that infants thrive best in fresh air heated to 80° F.

During the last few years the incubator has been used extensively by me. I have had success and I have had failures in the heated room. Likewise I have had failures and success in the incubators.

Many hospitals are discarding the incubator and giving preference to the heated rooms. At the Sloane Maternity, however, the incubator is still in use. While abroad visiting various infant hospitals, I found that Pirquet in Vienna favors the large warm room with good ventilation rather than the small incuba-

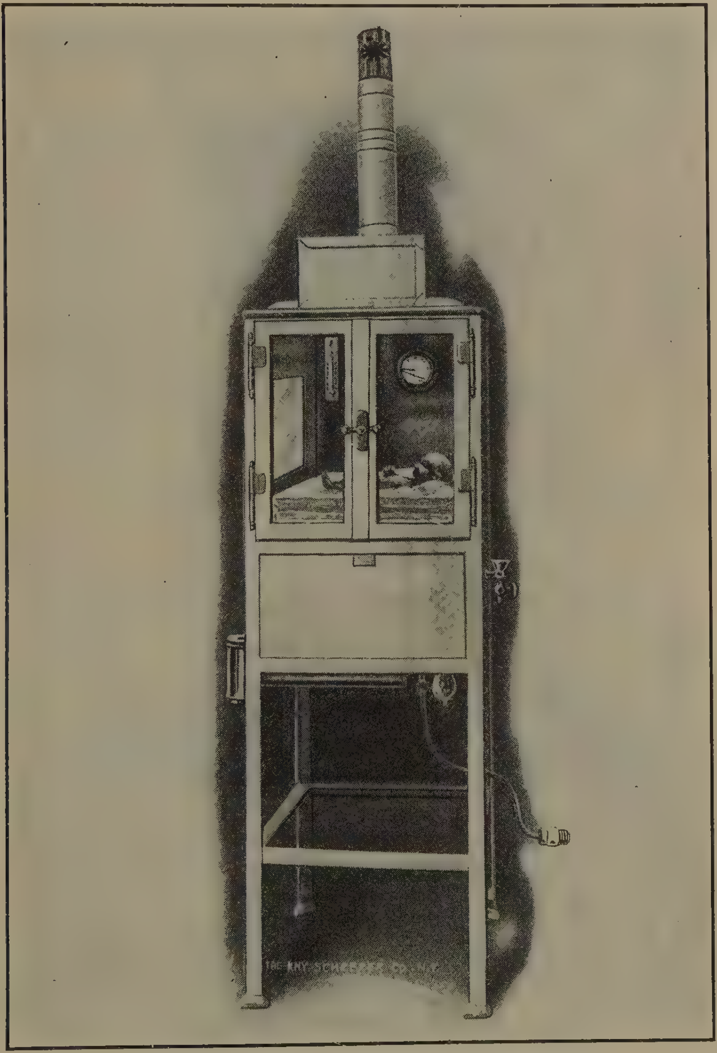

Fig. 6.—Incubator made by the Kny-Scheerer
Company, New York.

tor. The baby should be warm up to the shoulders—but the head free.

At the Infantorium[1] we have two small wards reserved for the treatment of premature infants. In one of these wards the air is kept at a temperature of 80° F. In another ward we have electrically heated incubators.[2]

Sunlight is always admitted. These infants are given a daily rub with warm oil, and their napkins are changed morning and evening. Owing to their sensitive condition they are not exposed by dressing and undressing more than once a day. Tub bathing is omitted.

In an emergency a clothes basket lined with absorbent cotton or blankets, and heated by means of hot water bottles can be used. These hot water bottles radiate their heat and should be refilled with hot water at least once in two hours, day and night.

The incubator here described (see Fig. 6) is the one used at the Sloane Maternity Hospital and at the Infantorium. A great variety of these incubators are manufactured.

Owing to its expense, the manufacturers will lend an incubator for a nominal sum per month.

The apparatus is constructed of steel, with glass doors and one glass window on the side for feeding purposes, etc.

The heat is generated by electricity and can be regulated to any desired temperature. The electric thermostat is suspended from the ceiling of the chamber. At its left end is a thumbscrew, which regulates the amount of heat. Underneath the cradle and above the heater is a water pan, which should be well filled with water. This is to supply moisture to the air in the apparatus, the amount of which is recorded by the hygrometer attached to the rear wall. The air supplied to the infant is filtered through an absorbent cotton filter. This air can be taken from the room in which the apparatus is placed, or directly from the outside by means of simple tubes. The revolving wheel in the chimney indicates the perfect circulation of the air. This apparatus can also be supplied with a gas heat-generator, the electric being preferred in order to minimize the contamination of the air.

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[1] An institution in New York City which specializes in nutritional disturbances of infants, and admits many premature infants.

[2] Kny-Scheerer Company, New York City.

A great danger in the care of these babies is their susceptibility to infections. The incubator itself is a great germ carrier and should be regularly cleansed. The weakness of the lungs and gastroenteric tract makes the infant especially vulnerable.

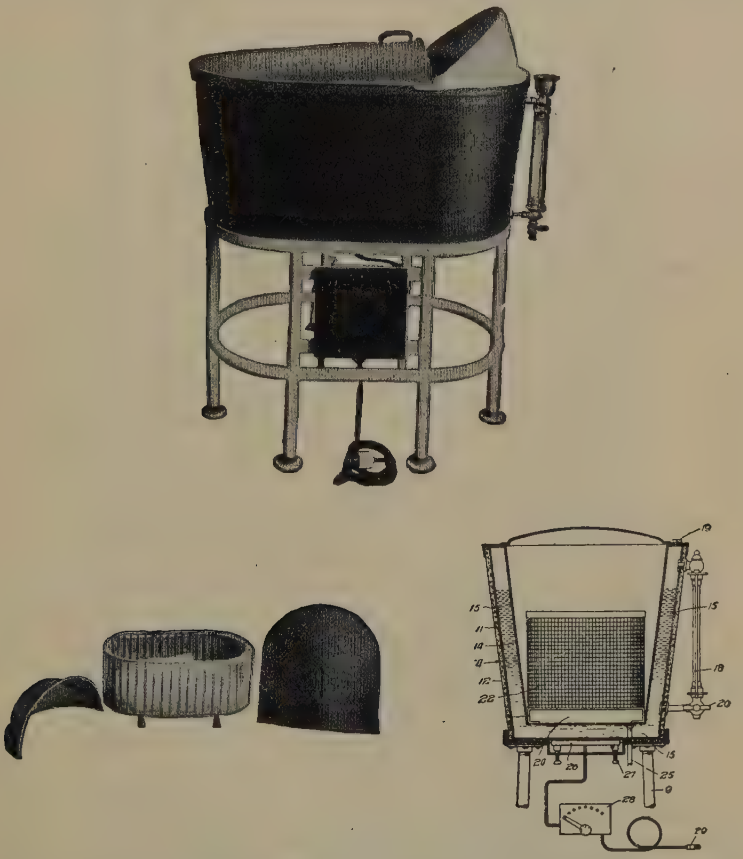


Fig. 7.—Incubator bed designed by Dr. Julius H. Hess, of Chicago. Well adapted for premature infants. Its use in the Michael Reese Hospital has demonstrated its practical value. Cross section: *4*, copper wall covering asbestos layer; *9*, stand supporting bed; *11*, and *14*, inner and outer walls of copper water jacket; *12*, asbestos layer insulating water jacket; *15*, water within jacket surrounding sides and floor of bed; *18*, water gauge; *19*, plug in opening used for filling jacket; *20*, cock for emptying jacket; *22*, removable crib; *24*, air space underneath crib; *26*, heating plate; *28*, rheostat; *29*, electric plug.

Unless the air is filtered, dirt is carried in continuously; consequently, the streptococcus, staphylococcus, and pneumococcus

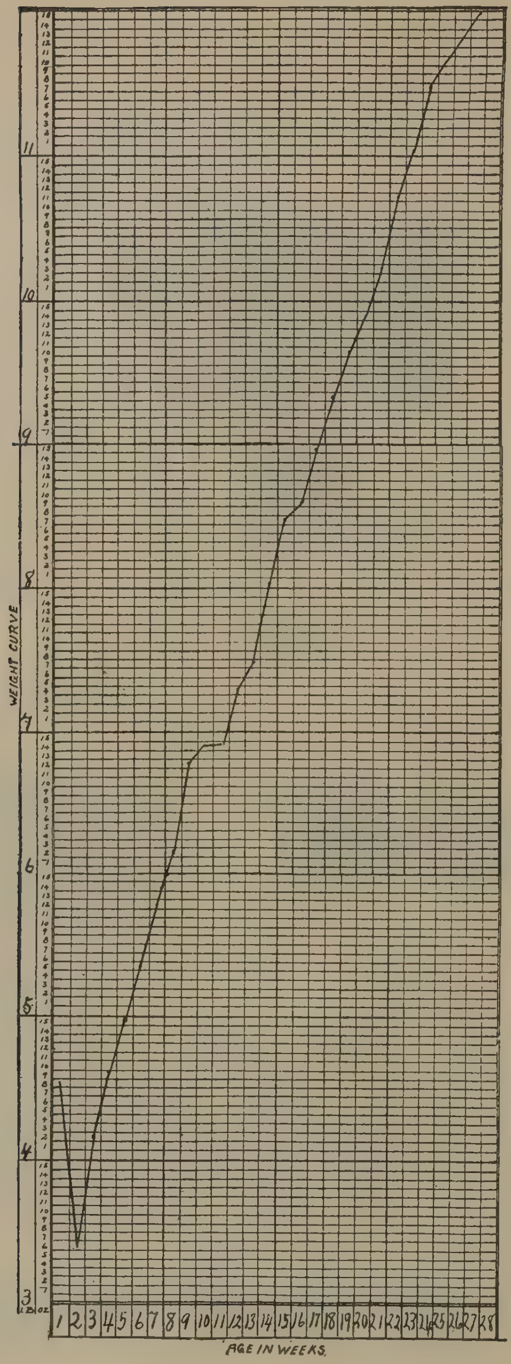


Fig. 8.—Chart of baby B. An incubator baby. The chart illustrates the loss in weight after birth to 3 lbs. 6½ ozs. during the second week. The child gained steadily thereafter.

are always present, seeking an avenue of entrance. Through the skin in eczematous spots or in areas of irritation, at the navel, through the eyes, nose, mouth, larynx, lungs, and rectum, the bacteria can gain admission. To prevent infection the most careful cleansing is necessary, of both the incubator and the baby. Undoubtedly most of the deaths of our cases could be traced to this source.

The Incubator Bed.—An incubator bed was seen by me at the Michael Reese Hospital in Chicago. It has many advantages. In Boston I recently saw hot air rooms for premature infants. In many hospitals the incubators have been abandoned. During the summer of 1920 while visiting the infants hospital in Vienna with Dr. Pirquet I was informed that the incubator has been discarded and replaced by a small box or casket which covers the body up to the neck but does not cover the head.

It is believed that the larger rooms with fresh air currents give better results than the small incubators. My own results have been excellent both with the electrically heated incubator as well as in the hot air rooms.

My experience with premature infants during the last few years includes a series of 50 cases. Many of these infants were born during the influenza epidemic of 1919 and 1920. One of these infants weighed 3 pounds and 12 ounces, several between 4 and 5 pounds, and many between 5 and 6 pounds.

The strict supervision of an incubator requires two trained nurses. The heat must be regulated. The thermometer inside the incubator must be observed frequently, and the moisture properly regulated so that the air within the incubator is not too dry.

Some infants require the incubator four weeks until the weight reaches 6 pounds and the temperature becomes normal. Other infants have remained in the incubator two months before their normal birth weight was reached. After all one must be guided by the appetite, the stool, the gain in weight, and the general condition as indications for the removal from the incubator.

The objections raised to the incubator by some authors, concerning lack of oxygen and lack of humidity do not hold good in my experience. Our results have been excellent. To place an infant in an incubator means responsibility and care night and day if successful results are to be expected. To place an infant in an incubator and feed it at stated hours, but neglect it otherwise means fatalities. The puny, premature infant must be watched during each meal and not be permitted to feed alone. Infants are liable to suffocate if allowed to feed themselves without assistance and careful watching. Cases of asphyxia are frequently reported in the literature, and these cases are due to lack of proper supervision during feeding.

Premature infants lose considerably more weight in proportion to their birth weight than infants at term. This is due to their immature digestive tract, also the fact that they are almost always intensely jaundiced. They gain very slowly, and if at the end of two or three weeks they have reached their birth weight they have done unusually well.

Water should be given frequently as the heat of the incubator produces dryness of mouth and lips.

The Mouth.—Owing to the delicate structure it is inadvisable to cleanse with antiseptic solutions. Stomatitis, sprue, Bednar's aphthæ are the result of unnecessary cleansing of the mouth. Fresh water given after feeding is the best mouth cleanser.

The infant should remain in the incubator continuously. When the body temperature of the premature infant reaches normal then the incubator is no longer required.

At the Infantorium we give the feeding every hour or two hours. If the infant is born in summer we keep it in the incubator until the weight reaches 5½ pounds, in winter until the weight reaches 6 pounds. As a rule these infants are restless when taken out of the incubator, and sleep quietly when placed back into the incubator. If they are restless in the incubator usually one of two things will be found—they are hungry or they are soiled.

Feeding.—The life of a premature infant depends on its assimilation of food. Human milk is indispensable. If the mother cannot supply the milk we should try to substitute the milk of a wet-nurse or any other human milk. The usual precaution of taking a Wassermann of the wet-nurse is necessary. In case of an emergency the human milk can be pasteurized by steaming it twenty minutes at a temperature of 140° F., then it will be safe.

If the human milk is scanty or we cannot obtain a sufficient supply, a supplementary feeding of Dryco can be given. Thus we alternate human milk and Dryco every two hours.

One teaspoonful of Dryco added to 1 ounce of water may be given every hour. If the infant seems hungry add 2 teaspoonfuls of Dryco to 1½ ounces of water. By studying the appetite we can easily increase the quantity of Dryco until sufficient food is taken. Gavage may be necessary in many infants.

The x-ray has shown that while the capacity of an infantile stomach may be but 2 or 4 ounces, food leaves the stomach through the pylorus during the meal and passes into the duodenum. It proves that the older method of calculating food quantity based on stomach capacity was wrong and accounts for symptoms of hunger in many infants, after feeding. This is an important point in feeding a premature or puny infant and it has proven that the actual stomach capacity is not the criterion to go by in prescribing a definite quantity for each feeding.

The feeding interval in a premature infant should be two hours day and night. One can easily detect hunger by the restlessness which the infant shows or by the whine one-half hour before feeding time. If, for instance, the infant has been fed at 2 o'clock and regurgitated part of its food, it is wrong to wait two hours before feeding again. We should feed in one and one-half hours or even one hour after such vomiting.

Weight.—The weight of a premature baby must be taken daily and at the same time of the day, always before feeding. We should inquire when the bowels moved and make allowances for the same. It is wrong to weigh a baby in a haphazard manner, before a meal today and after a meal tomorrow. I have seen a baby reported to have lost weight by one nurse and gained 1 ounce on the same day by another nurse, when two different nurses weighed the child. If the infant is gaining in weight and having good stools then let it alone, continue to feed in the same way, be it human milk, dry milk or evaporated; but if the infant is losing weight and is beginning to show signs of a weakened pulse then warm saline injections or hypodermoclysis should be given, 1 or 2 ounces of normal saline solution at a temperature of 105° into the loose cellular tissue of the abdomen. If we can procure a donor then no therapeutic agent will equal a transfusion.

If the infant seems satisfied but does not gain in weight then ½ teaspoonful of malt sugar such as dextri-maltose should be added to the dry milk. In some cases excellent results are obtained with condensed milk and with evaporated milk. As the latter does not contain sugar ¼ teaspoonful of cane sugar or ½ teaspoonful of malt sugar should be added to every other feeding. If any pyloric irritation exists, and vomiting follows the use of the milk, then milk skimmed of all cream should be substituted.

When vomiting persists during skimmed milk or protein milk feeding, then sugar of all kinds must be omitted. Sugar is a disturbing factor in the diet of many infants but when the same is omitted the weight often remains stationary.

Boiled milk diluted with twice the quantity of water acts well in some infants.

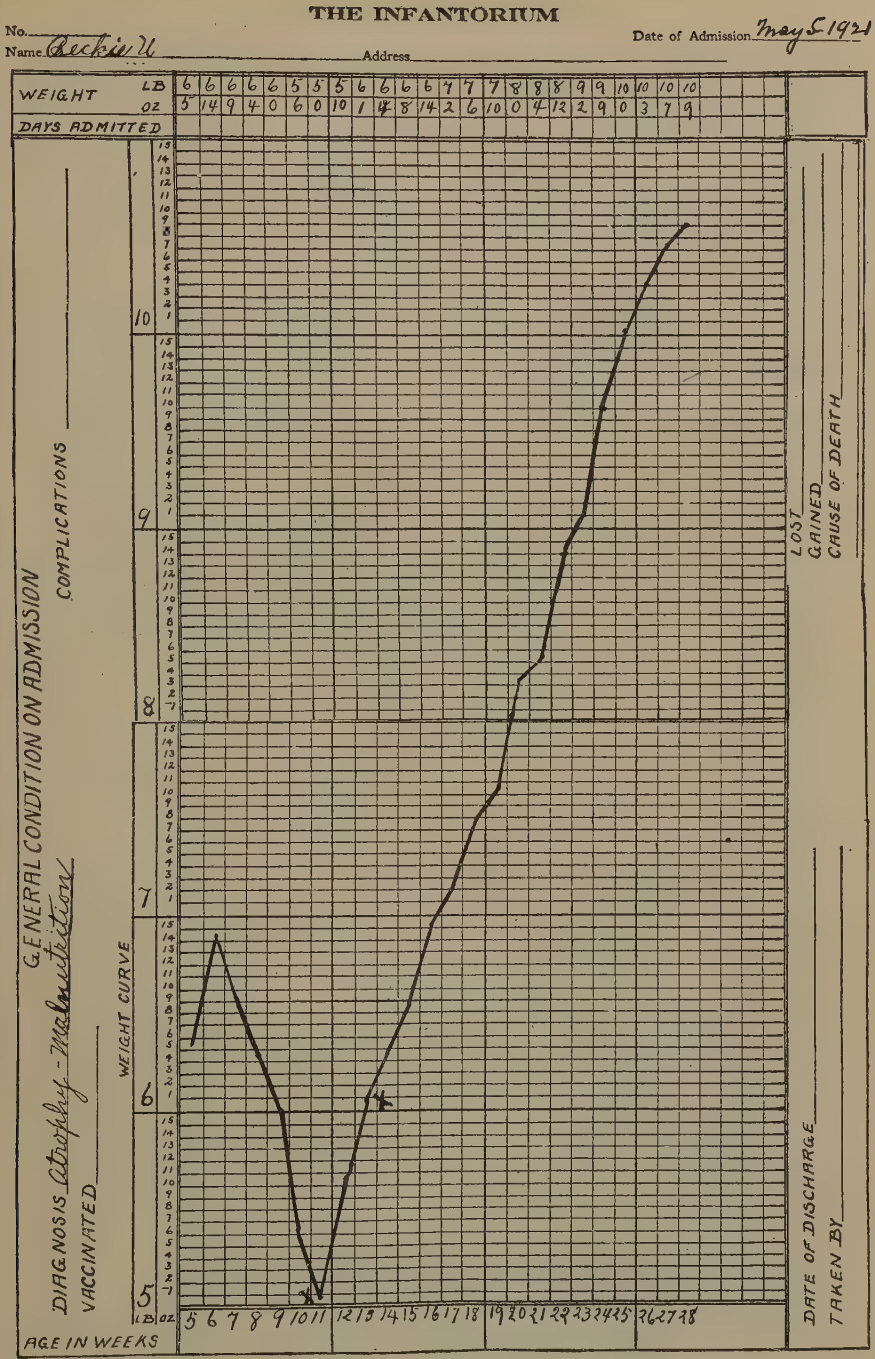
Drug Treatment.—The premature infant should not be drugged. The lining of the stomach is so sensitive that we should not irritate the same. The only medication that I have resorted to is a pinch of bicarbonate of soda added to a little lukewarm water once or twice a day.

The premature infant is not doomed. Literature records many successful cases that have grown to be strong healthy children. It is a serious problem to have an infant weighing 3½ or 4 pounds when the normal infant weighs twice as much, but how gratifying it is to see progressive development and a successful outcome the result of persistent care and careful dieting!

Transfusion.—In malnutrition when the food is not properly assimilated and there is atrophy of the fat and muscles, transfusion is a life saver. In an infant weighing 5 to 6 pounds, 1 ounce of blood and in some instances ½ ounce of blood may be sufficient to begin treatment. The transfusion is a simple operation and does not consume more than two minutes. While the donor's blood should be tested for hemolysis and agglutination —in an emergency we can inject ½ ounce of blood to which 5 cubic centimeters of a 0.2 per cent. citrated soda solution is added and thoroughly mixed without first testing the blood.

The injections should be given through the posterior portion of the fontanel directly into the longitudinal sinus. Many infants so injected have responded and gained in weight.

Such transfusions can be repeated every three days if no improvement is apparent. The transfusion is but one part of the treatment. Great care must be taken in maintaining warmth by artificial means and by giving sufficient food by mouth. The instillation of 2 ounces of hot normal saline solution by means of a hypodermoclysis will add fluid to the body and aid elimination. Such hypodermoclysis can be given daily into the loose cellular



THE INFANTORIUM

No.

Name Beckie U

Address

Date of Admission May 5 1921

GENERAL CONDITION ON ADMISSION

DIAGNOSIS Atrophy - Malnutrition

VACCINATED

WEIGHT LB	6	6	6	6	6	5	5	5	6	6	6	6	7	7	7	8	8	8	9	9	10	10	10	10
OZ	5	14	9	4	0	6	0	10	1	4	8	14	2	6	10	0	4	12	2	9	0	3	7	9
DAYS ADMITTED																								
AGE IN WEEKS (LB OZ)	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28

Fig. 9.—Weight chart following transfusion.

tissue between the scapulæ. The temperature of the solution should be about 110° F.

Case V.—Beckie U., a twin born Nov. 1, 1920, was 5 weeks old when admitted to the Infantorium. She was referred by the New York Hospital S. S. as a feeding case. The infant's appetite was poor, circulation bad and the extremities cold.

Diagnosis.—Atrophy. Faulty metabolism.

During the first week feeding consisted of Dryco, 5 drams to 3 ounces of water every three hours. It took over one-half hour to feed 2 ounces of food. Due to exposure in transferring from one hospital to another the infant developed a slight bronchitis. She lost weight, and did not assimilate her food well. She was gavaged three times a day for several weeks with intermediate feedings. On Jan. 17, 1921 her weight was 5 pounds. She was listless and the prognosis was absolutely fatal. We sent for her father to act as donor. A transfusion of 25 cubic centimeters of citrated blood was given into the superior longitudinal sinus by Dr. Burk and myself. The infant responded by taking its food better and in twenty-four hours had gained 3 ounces. The appetite improved so that gavage was unnecessary. Two days after the transfusion the infant's appetite had improved so that 2½ ounces were taken readily. Improvement continued and on the 30th of January the infant had gained 15 ounces since the transfusion. It was decided to do a second transfusion, two weeks after the first. The father again acted as donor and we injected 30 cubic centimeters of citrated blood, using the sinus route. After the second transfusion there was a slight cyanosis, intermittent and irregular pulse which lasted about fifteen minutes. The breathing seemed labored, there were evidences of intracranial pressure which subsided in an hour. The circulation was re-established, the pulse regular, the infant slept, and took its bottle well.

Dryco was continued, gradually increasing from 5 teaspoonfuls in 3 ounces of hot water until 12 teaspoonfuls were given in 5 ounces of hot water. Besides the Dryco 1 pint of a concentrated spinach water, and the following day carrot water was given.

When the weight had increased to 8 pounds a supplementary feeding of whole milk diluted with equal parts of barley water and dextri-maltose was given. This agreed very well and after one week Dryco was discontinued and modified milk given at each feeding.

The Stools.—Before the first transfusion the stools contained mucus, they were green and resembled spinach stools seen in starvation. They contained particles of undigested food. After the first transfusion metabolism was improved and the food was better digested and the feces contained less mucus. Before the transfusion there was an evacuation at each feeding. Swallowing the food seemed to stimulate peristalsis. After the transfusion there were less stools with a better consistency and much less mucus. The buttocks were constantly excoriated and despite hygienic care each fresh evacuation seemed to provoke a new source of irritation. When the stools decreased in number they contained much less acidity and did not irritate as before. The clinical picture of a moribund infant dying very fast was transformed by this transfusion. The infant progressed until it could take vegetable pulp in addition to a slight amount of cereal. The infant was discharged to the country, May 17, 1921. Weight, 10 pounds and 7 ounces.

PREMATURE INFANT DON'TS.

Do not remove from the incubator to change its soiled linen.

Do not bathe the infant.

Do not allow it to feed itself.

Do not put a nipple in its mouth and walk away from it.

Do not forget that asphyxiation will result if an infant is left alone during feeding.

Do not remove it from the warm room or incubator to give it the oil rub.

Cleanse the mouth by giving a drink of water after feeding.

Do not rub the delicate mucous membrane for hygienic purpose.

Remember that Bednar's aphthæ are caused by traumatism.

Success depends on (*a*) Human milk.
(*b*) Inhalation of oxygen.
(*c*) Warmth.

V.

MATERNAL FEEDING—WET-NURSING.

COLOSTRUM.

Colostrum is found in the breast of a woman several hours after giving birth to her infant. It resembles milk, but is a much thinner fluid. It is always the forerunner of a healthy normal secretion of milk which usually appears on the third day after the birth of the infant.

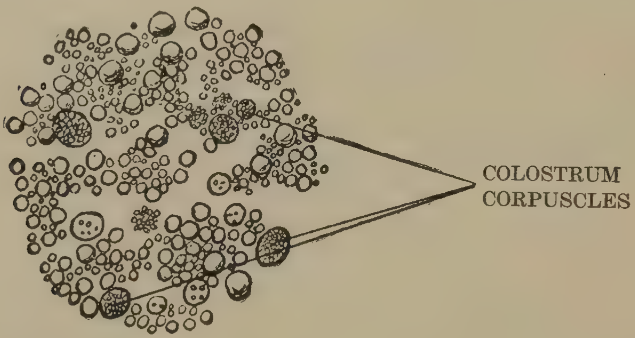


Fig. 10.—From a drop of milk on the third day after delivery.

Colostrum corpuscles have been described by Czerny as lymphoid cells, whose function is to absorb and reconstruct unused milk globules and to convey them from the milk-glands into the lymph-channels. These corpuscles usually disappear in one week or ten days after birth. When colostrum corpuscles are present after one month, then such milk will cause gastric disturbances. It is a wise plan to examine the milk microscopically whenever the slightest evidence of gastric or intestinal disturbance is noted.

According to Baginsky, colostrum contains large quantities of serum-albumin, and is also very rich in fat and colostrum corpuscles, and contains a large quantity of salts. The last *two ingredients* are supposed to be the cause of the *laxative action* of the colostrum.

When colostrum corpuscles persist in human milk, in spite of the regulated diet and the hygienic condition of the mother, then breast-feeding must be discontinued. A very fretful and nervous mother will frequently have colostrum corpuscles in her milk. An instance of this kind was seen recently by me. Substitute feeding will frequently modify this condition unless there is a specific cause for the same. When a nursing mother is very weak and anemic after her confinement, then iron is indicated. I saw a case in consultation recently in which the combined use of fresh air, cereals, and iron changed a thin milk containing colostrum corpuscles into a thick, creamy milk in less than one month. Continued menstruation or uterine disorder with disease in the endometrium may cause profound anemia and thus render human milk very thin. Such milk is totally unfit for the proper nutrition of the infant.

HUMAN MILK.

According to Pfeiffer, human milk contains, several days after the birth of the infant, a large quantity of albumin, salt, and a small quantity of fat. He also found that *the longer the period of nursing, the smaller the quantity of albumin*, which, in the eleventh month becomes quite small. There is also a *decrease in the quantity of salts*, whereas the *amount of sugar* steadily increases. The *fat varies* constantly. According to Johannessen, the quantity of albumin in the first six months is 1.192 per cent.; in the next six months 0.989 per cent., and at the end of the year 0.907 per cent.

TABLE No. 2.

PROPERTIES OF HUMAN MILK.

Appearance.	Bluish, semi-transparent, no odor, sweetish.
Specific gravity.	1.026 to 1.036.
Reaction.	Amphoteric to litmus, acid to phenolphthalein.
On boiling.	Does not coagulate, and forms a very thin, hardly perceptible skin.
Coagulates.	At ordinary temperature after several hours.
Coagulates on addition of Lab-ferment.	Coagulates imperfectly in small isolated flakes, which do not precipitate as a uniform coagulum.
Fat.	Yellowish white, resembling cow-butter. Specific gravity at 15° C., 0.966. Melts at 34° C.

TABLE NO. 2 (*continued*).

Varieties of fat.	Butyrin, palmitin, stearin, olein, myristin, caproin, lecithin, cholesterin.
Behavior of various acids.	Few volatile acids. More than half of the non-volatile consist of oleic acid.
Milk-plasma casein.	Difficult to precipitate with acids and salts. The precipitate redissolves in excess of acids. During pepsin digestion there is no pseudonuclein produced.
Composition of proteins.	Lactalbumin and lactoglobulin; relation of casein to albumin, 0.5 to 1.2 or 1 to 2.4; of the 1.2 per cent. albumin, there are 64 parts of casein, and 36 parts of globulin and albumin.
Solids.	Less solids than in cows' milk, especially CaO—P_2O_5.
Quantitative analysis, according to Soxhlet.	Water, 87.41; protein, 2.29; fat, 3.78; milk-sugar, 6.21; salts, 0.31.
Bacteria.	Usually sterile, rarely staphylococcus albus and aureus.

TABLE NO. 3.

PROPERTIES OF COWS' MILK.

Appearance.	Opaque white or whitish yellow, in thin layers bluish white, slight odor, faintly sweet.
Specific gravity.	1.028 to 1.036.
Reaction.	Amphoteric to litmus, acid to phenolphthalein.
On boiling.	Does not coagulate and forms a skin containing casein and lime-salts.
Coagulates.	Coagulates very soon, owing to lactic-acid formation.
Coagulates on addition of Lab-ferment.	Coagulates to a solid mass at body-temperature, from which a yellowish fluid can be expressed.
Fat.	Yellowish-white mass. Specific gravity at 15° C., 0.949 to 0.996.
Varieties of fat.	Palmitin, olein, stearin, myristin, caprilin, caprin, caproin, butyrin, laurin, lecithin, cholesterin, and yellow coloring matter.
Behavior of various acids.	Volatile fatty acids, about 70 per cent.; not volatile, 0.3 to 0.4 per cent. of oleic; the remainder consists of palmitic and stearic chiefly.
Milk-plasma casein.	Easy to precipitate with acids and salts; excess of acid does not dissolve; belongs to the nucleo-albumin group.

TABLE No. 3 (*continued*).

Composition of proteins.	Less lactalbumin and globulin; the largest portion of the albuminoids is casein. Relation of casein to albumin, 0.3 to 3.0, or 1 to 10.
Solids.	Cows' milk contains more solids than human milk.
Quantitative analysis, according to Soxhlet.	Water, 87.17; protein, 3.55; fat, 3.69; milk-sugar, 4.88; salts, 0.71.
Bacteria.	Contains all milk bacteria, frequently also pathogenic bacteria, as typhoid, diphtheria, and tubercle bacilli, etc.

Human milk varies according to the length of time that it remains in the breast, and also the length of the nursing period; so it has been shown that the first milk taken at the beginning of the nursing act is the poorest in nutrient value, whereas the last milk is richest in fat. The longer the milk remains in the glands of the breast, the more will the solid substances of the same be absorbed, so that only a watery solution remains. If sucking is commenced, this stimulation soon changes the character of this watery milk, so that normal milk will soon be secreted. Forster studied the chemical constitution of the first, middle, and the last portions of milk from a nursing woman, with the following result.

In 100 parts he found:—

TABLE No. 4.

	First Portion of the Nursing Act.	Second Portion During Nursing.	Third Portion at the End of the Nursing Act.
Water	90.24	89.68	87.50
Nitrogenous substances	1.13	0.94	0.71
Fat	1.70	2.77	4.51
Sugar	5.56	5.70	5.10
Ash	0.46	0.32	0.28

The quantity examined was 37.3 grams.

From a study of the foregoing tables we find a decrease of nitrogenous substances during the course of the nursing, a steady increase in the amount of fat, and an unvarying percentage of sugar. Thus, it is apparent that, in order to submit *a specimen of human milk to a chemical examination,* it is necessary to stimulate the secretory functions of the mammary glands by putting the child to the breast at least two minutes; thus an even milk can be procured. If this rule is overlooked, then we shall find proportions in the chemical components of milk which might otherwise be entirely different. A recent chemical analysis of human milk shows that in a hundred parts there are:—

Solids	12.5
Liquids	87.5

Of the solid constituents there are:—

Casein	1.2 to 1.03
Albumin	0.5
Fat	0.8 to 4.07
Milk-sugar	6.0 to 7.03
Ash	0.2 to 0.21

The above is the chemical examination of a good average human milk; I again call attention to the fact, however, that not only does the milk vary in different women, but it also varies in the same woman during one single nursing act.

The proteins of milk consist of real casein, lactalbumin, globulin, and opalisin. This latter body was discovered by A. Wroblewski, and authenticated by Schlossmann.

Phosphorus exists in milk as nuclein-phosphorus. Wittmaack has demonstrated the fact that the phosphorus in human milk exists as an organic nitrogen compound in the casein.

According to the examination of Stolasa, lecithin contains a larger quantity of phosphorus in human milk than in cows' milk.

The Mammary Glands.—The mammary glands of the same woman may yield somewhat different milk, as shown by Sourdat and later by Brunner. Also the different portions of milk from the same milking may have different compositions. The first portions are always poorer in fat (Parmentier, Peligot, and others).

According to Vernois and Becquerel, the milk of blondes contains less casein than that of brunettes: A difference which Tolmatscheff could not substantiate. Women of weak constitutions yield a milk richer in solids, especially in casein, than women with strong constitutions.

According to Vernois and Becquerel, the age of the woman has an effect on the composition of the milk, so that we find a greater quantity of protein and fat in women 15 to 20 years old and a smaller quantity of sugar. The smallest quantity of protein and the greatest quantity of sugar are found from 25 to 30 years of age. The milk with the first-born is richer in water—with a proportionate diminution of the quantity of casein, sugar, and fat—than after several deliveries. The influence of menstruation seems to slightly diminish the milk sugar and to considerably increase the fat and casein.

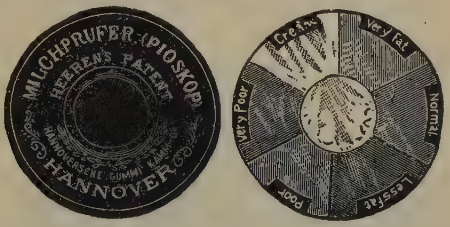


Fig. 11.—Heeren's pioscop, for optical milk test.

Pioscop.—One drop of milk can be examined in the pioscop and compared with the colors on the same. This is a rapid but rough method of estimating the richness of the milk.

TABLE NO. 5.—COMPARATIVE ANALYSES OF HUMAN MILK.

Human Milk.	Fat	Proteins	Sugar	Ash	Authority.
Normal Milk					
Average	2.90	3.07	5.87	0.16	A. W. Blythe.
Average	3.68	1.70	7.11	0.20	Marchand.
Average	2.67	3.92	4.37	0.14	Vernois and Becquerel.
Average	3.52	2.01	5.91	....	Hammarsten.
14 analyses from same woman	2.53	3.42	4.82	0.23	Simon.
Mean of 6, aged 23-33 years.	3.82	2.04	5.93	0.42	H. Gerber.
Average	3.55	1.52	6.50	0.45	Chevalier and Henry.
From woman aged 18	3.20	2.39	6 83	0.29	J. Bell.
From woman aged 33	2.99	2.51	6.51	0.30	J. Bell.
4 days after delivery	4.30	3.53	4.11	0.21	Clemm.
9 days after delivery	3.53	3.69	4.30	0.17	Clemm.
12 days after delivery	3.34	2.91	3.15	0.19	Clemm.
Average of 84 samples	4 13	2.00	6.94	0.20	Leeds.
Average of 107 samples	3.78	2.09	6.21	0.31	König.

Specimen of Human Milk for Chemical Examination.—After the third, possibly the fourth day the average healthy woman secretes milk that gradually becomes normal in quality and quantity, depending on her general condition. It is usual for an infant to lose some weight during its first week of life, owing to various physiological changes, added to which is, no doubt, the deficiency in the quality and quantity of its food. It is a safe plan, and one that I have always urged, if at all possible, to send a specimen of human milk to a chemist and submit the same to a chemical analysis. In some women a specimen can be examined when the baby is 1 week old; in others it is better to wait until the end of two weeks. We then have a proper working basis, and know just how much fat, carbohydrate, and protein we are feeding. Noting the weight of the child, its sleep, its digestion, color and frequency of its stools, we can easily see in one week how much the infant has gained in weight, and its general condition. To take a specimen, it is advisable to have all utensils absolutely clean; hence the following plan would be suggested: Boil an ordinary 1- or 2- ounce bottle in water, to which a pinch of baking soda has been added, for about one-half hour. Then place the bottle in plain water and boil again for a half-hour. Then turn the bottle upside down, and allow it to drain and dry. In this manner we can completely sterilize the inside of the bottle and avoid contamination.

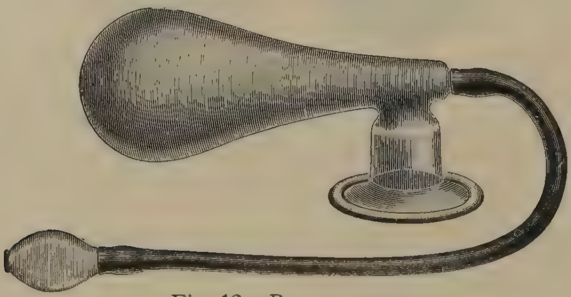


Fig. 12.—Breast-pump.

Withdraw a sample of human milk by means of a breast-pump. One which has served the author very well is known as the Florence breast-pump, and has a glass mouth-piece. (See Fig. 20.) Another form is an English breast-pump, having a rubber bulb (Fig. 12). Compressing this bulb, we can suck about an ounce or more in from five to ten minutes. This milk is to be poured into the bottle, and well corked, and set in a refrigerator, but not on the ice. Milk will keep for many hours in this way. My plan has been to inform the chemist the day previous to submitting the sample, so that it can be withdrawn from the breast early in the morning—at about 8 A.M.—and sent to the laboratory at once. The result of the analysis can be received on the evening of the same day or on the following day in all instances. A point worth noting is that the very first milk should not be used, but the infant should be allowed to suck at the breast for about two minutes before pumping the sample. After this the breast-pump should be applied for five minutes to procure the middle milk; then the infant can again be put to the breast to finish nursing.

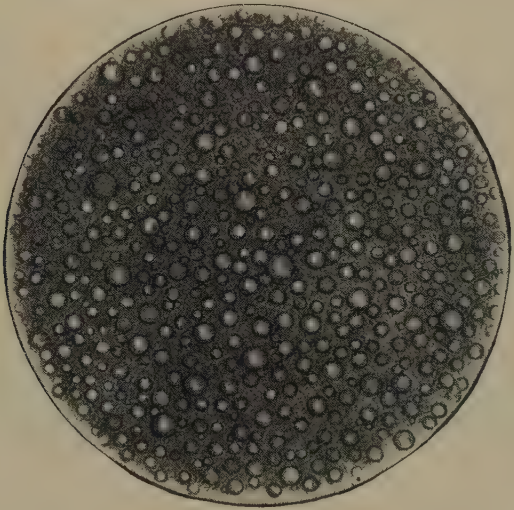


Fig. 13.—A drop of normal breast-milk from a primipara.

Examination of Human Milk.—A method which can be employed in general practice is recommended by Friedmann. It is more easily done than a chemical analysis, and serves an equal purpose. It consists of determining by microscopical examination the number and character of the milk corpuscles. It is an advantage first to become familiar with the normal conditions by repeated examinations of the milk from healthy mothers, those whose children are well and show no sign of rickets or glandular enlargements. The milk corpuscles can be divided as to size into three groups: large, small and intermediate, of which the latter are most numerous. The small ones are also found in almost equal numbers, but the large ones are comparatively scarce, a magnification of 400 diameters showing only about 10-20 in the field. If these be more numerous the milk is found to be too fatty and more difficult to digest. A preponderance of the small corpuscles usually means a chronic dyspepsia for the nursing infant. An accurate count can be made with some form of blood-counting apparatus, but the latter is not essential. The proximity of the corpuscles to each other also serves as a guide to the grade of the milk, the more sparsely distributed the globules and the greater the number of the small ones, the poorer the quality of the milk. The method also serves to differentiate the character of the milk from the two breasts. In the selection of wet-nurses it is obviously useful.

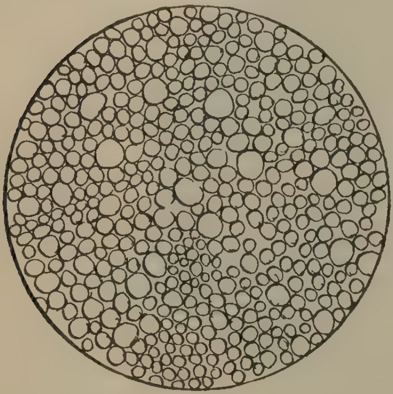


Fig. 14.—Specimen of breast-milk from a young mother, 17 years old. Primipara. Baby 4 months old; thriving; gaining in weight; stools yellow; sleeps well. Chemical examination: Fat, 2.60; sugar, 6.50; proteins, 2.54. Milk looks creamy, and the mammæ are well filled.

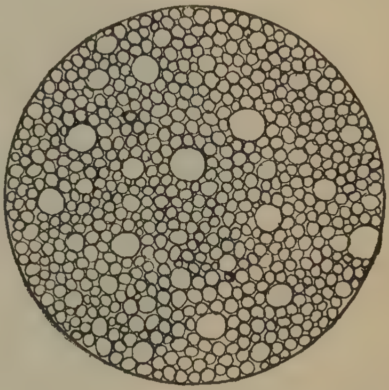


Fig. 15.—Specimen of breast-milk, illustrating very high fat, causing gastric disturbance. Baby gaining; vomits frequently; stools yellowish; bluish-white milk; child sleeps well; excessive fats. Chemical analysis: Fat, 5.0; sugar, 6.50; proteins, 1.74; ash, 0.20.

Reaction of Human Milk.—Bordet has called attention to the precipitation of the proteins in milk when it is added to the serum in animals which have been previously injected with milk from the same source. Schlossmann found, further, that the fluid from a hydrocele on a breast child was also able to precipitate the proteins in human, but not in cows' milk. According to Moro, if a few drops of human milk are added to a few cubic centimeters of fluid from a hydrocele, in a very few minutes the hydrocele fluid coagulates into a solid mass. This reaction does not occur with cows' or goats' milk. The hydrocele fluid evidently contains fibrinogen, and the milk, fibrin ferment. The combination of the two induces the coagulation. It occurs even with minute quantities of the milk; all the serum in contact with the milk coagulates around it. The same reaction occurs when human serum is added instead of the milk, but much less pronounced and much slower, and the same difference is observed when the human milk is boiled or long heated. Particles of coagulated ox blood also induced a slow and partial coagulation.

To Preserve Human Milk.—Human milk collected from various women may be preserved for many weeks if treated in the following manner: Test the milk with litmus paper to be sure that it is amphoteric or alkaline. If it is not alkaline, add a few drops of bicarbonate of soda solution. Then add 0.2 cubic centimeters of a concentrated 30 per cent. perhydrol solution. This quantity of perhydrol is sufficient for 400 cubic centimeters of milk. The milk is then thoroughly shaken so that the perhydrol produces its chemical effect. On close inspection small bubbles can be seen in the milk. Lastly the milk is heated for ten minutes in a water bath to 120° F.

TABLE NO. 6.—FIVE ANALYSES OF HUMAN BREAST-MILK.[1]

	Case No. 1. Per cent.	Case No. 2. Per cent.	Case No. 3. Per cent.	Case No. 4. Per cent.	Case No. 5. Per cent.
Water	86.2	89.0	87.0	88.6	88.1
Proteins ..	1.7	1.3	1.6	1.1	1.1
Lactose ...	6.5	5.8	6.6	6.7	6.2
Fat	5.4	2.5	3.8	2.7	4.1
Salts	0.2	0.3	0.2	...	...

Case I of Table 6 showed symptoms of gastric disturbance, chiefly vomiting, caused by feeding high fat. The mother of the infant believed that by eating frequently and of very rich food, she would benefit her baby, thus her milk showed 5.4 per cent. of fat.

By reducing her diet, excluding meat and too many eggs, discontinuing alcoholic and malted beverages, her milk improved, the fat being decreased. Exercise, such as walking, was ordered for the mother.

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[1] Analyses made by Lafayette B. Mendel.

TABLE NO. 7.—TABLE SHOWING ANALYSES OF A NORMAL, A POOR, AN OVER-RICH, AND A BAD HUMAN MILK.

	Normal Milk. Exercise and Good Food.	Poor Milk. Poor Food. (Low Fat. High Protein.)	Over-rich Milk. Rich Food. No Exercise. (Excess of Fat.)	Bad Milk. Wet-nurse Menstruating. (Low Fat. Low Protein.)
Fat	4.00	1.00	6.59	.65
Sugar	6.50	6.50	6.69	6.50
Protein	1.75	2.36	1.16	1.12
Mineral matter ..	.19	.24	.19	.11
Total solids	12.44	10.10	14.63	8.38
Water	87.56	89.90	85.37	91.62
Total	100.00	100.00	100.00	100.00

The first three or four days require *special* feeding methods. On the day of the birth, the exhaustion of the mother and presence of colostrum, besides the normal deficient quantity of food in the breast, demand large intervals of rest between feedings. Thus for the first three days (unless the milk-supply is profuse) putting the infant to the breast once in six hours is sufficient; if, however, the supply of milk is ample, then we can follow the table given on page 45 and nurse the infant every three hours.

The virtues of human milk have been extolled from many infectious hospitals, where it is found that there is more vitality in an infant that nurses the human breast than in the infant reared by artificial means. The susceptibility to infections is far less in the infant nursed at the human breast than in the infant brought up by artificial means. What applies in infancy applies equally well in later life and there is no question in my mind that the breast-fed infant, being the stronger, will also be able to withstand the infection of tuberculosis in later life. Our plea should, therefore, be primarily for the education of the mother, especially so for the mother who believes the modern fad of artificial feeding is equally as good as the natural method.

An infant is not born with a diseased stomach. It is born with a healthy stomach, with normal digestion, and with power to assimilate almost any kind of food. Any one who will study the digestive conditions of the first six or eight weeks of infantile life, will find that almost every type of food will be assimilated. If an excess of fat or protein is ordered the same will not show marked systemic disturbance until after the first six or eight weeks of life. Feeding formulæ which would give rise to marked gastric disturbance during the third and fourth months are frequently well borne and apparently digested during the first month of life. This is because we are dealing with a healthy gastric mucosa plus normal secretions, and because pathological conditions have not yet developed. This accounts for the tolerance of high fats and high protein in early infancy.

Casein is a nucleoalbumin in a neutral combination with lime. Such casein will be precipitated on the addition of acid. It is not dissolved in milk, but exists therein in a colloid form. In addition to casein we have lactalbumin, which corresponds to serum-albumin. We also have lactoglobulin; both are also present in colostrum.

The albumin of milk if injected into a rabbit produces a serum which can give us the Bordet reaction. Alexins and antitoxins, agglutinins, complements, are found in human milk and transferred thereto by the serum. According to Ehrlich, these substances give marked resistance and a distinct passive immunity to the infant. During the last few years a study of the physiological requirements of the infant has demonstrated the fact that our feeding rules and feeding intervals have been wrong, that the tendency to overfeed exists, and that the interval for proper assimilation between meals is too small; hence we must change our methods to give the infantile stomach less work and at the same time sufficient food for its development.

An infant should nurse at birth seven times in twenty-four hours, or once every three hours. In special cases the infant may require feeding every two hours, but bear in mind that less frequent feedings stimulate a better flow of milk, give the infant a longer interval for digestion and thus an increased appetite.

When a scanty supply of human milk exists, then a mixed feeding, alternate breast and bottle, may be given, but it is important to look upon the human milk as the most precious food, and every drop is to be valued far more than the cows' milk that we use to supply the deficiency of the human breast. *A close study of infantile stools during maternal feeding has shown that there are frequently tendencies to either constipation or the reverse, loose or greenish stools. Neither of the above conditions should be regarded as serious factors and by no means should we look upon the human breast with disfavor even though the stools do not correspond to that* *desired yellowish, pasty consistency.* Many factors are at play; alkalinity or acidity of the intestine, chemical alterations in the milk, and atmospheric or thermic influences inhibit the proper function of the glands so that the intestinal ferments may or may not perform their functions. Such conditions must be borne in mind before a final conclusion to discard a human breast of milk is reached.

SUGGESTIONS FOR FEEDING.

Danger of Suffocation.—A great many cases are on record where the mother or wet-nurse has fallen asleep while nursing, and smothered the infant. For this reason it is important that the infant should sleep in its own crib or bed, and should never sleep with the mother or nurse.

Shall an Infant Nurse One or Both Breasts for One Meal?—This depends on the infant's appetite. Some infants appear satisfied after nursing from one breast, and will let go of the nipple and fall asleep. Lightly tapping the cheeks of the infant will awaken it, or the withdrawal of the nipple from the infant's mouth will frequently arouse it to continue nursing. If, however, the infant will not renew its nursing, and still continues to sleep, and if the infant has nursed steadily for ten minutes, then the sleep should not be disturbed.

Length of Time for Nursing.—A good plan is to note the time when the nursing act commences and stops. No infant should nurse longer than twenty minutes, whereas frequently ten or fifteen minutes will suffice. If an infant nurses more than twenty minutes, say thirty or forty minutes, then we may be sure that the milk is deficient in quantity and a specimen should at once be submitted for a proper chemical examination.

During the first and second months feed every three hours, but never oftener, if the child is well.

During the day awaken the child every three hours, for nursing; but during the night let the child rest as long as it appears satisfied. This rule applies to healthy children only. In sickness special rules for feeding are required. If the child thrives and gains in weight, then it is advisable to have an interval of from seven to eight hours at night; thus Bouchut advises the last feeding between 10 and 11 P.M., and the first feeding at 6 A.M. If the child is restless, then turn it from side to side; thus, changing its position and giving it 1 or 2 teaspoonfuls of boiled water will frequently satisfy it and prolong its sleep.

In the following table it is advised to feed an infant every three hours by day, up to midnight. In many cases, especially if we are dealing with a puny or delicate infant it may be necessary to feed every two hours. If the supply of milk is scanty and the infant seems dissatisfied the weight should be taken before and after several breast meals, to learn how much milk is being fed at each meal. The stools should be inspected, and the weight taken daily as a guide to the infant's progress.

TABLE No. 8.—TIME FOR FEEDING.

From Birth to 3 Months Old.	3 to 8 Months Old.	8 Months Until 1 Year Old.
6.00 A.M.	6.00 A.M.	6.00 A.M.
9.00 A.M.	9.30 A.M.	10.00 A.M.
12.00 Noon	1.00 P.M.	2.00 P.M.
3.00 P.M.	4.30 P.M.	6.00 P.M.
6.00 P.M.	8.00 P.M.	10.00 P.M.
9.00 P.M.	12.00 Midnight	
12.00 Midnight		

SCANTY MILK REQUIRING MIXED FEEDING.

When there is a deficiency in the quantity of milk, but the quality is good, then it is advisable to feed the infant alternately with human milk and cows' milk. At the same time it is advisable to direct attention to the mother's general condition, and see if we cannot tone her up, and thus improve both quality and quantity of her milk. Frequently a subnormal or an anemic condition requires iron. A day's outing to the country or seashore, with moderate exercise, will stimulate and increase the flow of milk. Every drop of milk is so precious that no infant should be deprived of it, and wise is the physician who will insist upon giving all human milk. When there is deficient lactation, supply the deficiency by giving a properly diluted milk or cream mixture, adapted for the age and weight of the infant.

COMPLEMENTARY FEEDING.

When an infant nursed at the mother's breast is not gaining normally, the weight should be taken before and after nursing to ascertain if there is a deficient quantity of milk. To make up a deficiency we can give the infant several ounces of cows' milk, diluted to the requirements of its age, after each nursing. This is called complementary feeding.

SUPPLEMENTARY FEEDING.

When the mother's milk is very scanty and she is unable to nurse her infant but 2 or 3 times a day, cows' milk diluted to the requirements, must be substituted for the alternate feedings. This is called supplementary feeding.

A nutritious diet such as milk, meat, eggs, vegetables, fruit, buttermilk, and cheese with sufficient exercise will stimulate the flow of breast milk.

The psychic condition of the nursing mother is the most important factor to be considered.

If she can be made to understand that the future well-being of her infant depends on her milk, and if she is given sufficient rest at night the milk can be stimulated thereby. In a large city where excitement, dissipation, and a nervous atmosphere exists, it is next to impossible to enforce ideal conditions necessary to stimulate the lacteal flow. One of the best stimulants is to apply the infant very frequently to the breast.

DO DRUGS TAKEN BY A NURSING WOMAN AFFECT THE BABY?

Physiological experiments have frequently demonstrated the fact that a great many drugs can be given to an infant through the milk; thus, opium and morphine and narcotics in general do affect the infant, when taken by the mother. Baginsky calls attention to this fact in his text-book on "Diseases of Children": "Alcohol, when taken by the mother, is transmitted through the milk, but not in very large quantities. The following is a list of drugs which have been found in milk: The purgative principles of rhubarb, senna, and castor-oil; the metals, antimony, arsenic, iodine, bismuth, lead, iron, mercury; the volatile oils, like copaiba, garlic, and turpentine; also salicylic acid, and the iodides and bromides." Do not give cocaine, chloral, atropine, or hyoscyamus. Care is to be used with the following: Digitalis, antipyrin, and ergot. An unpleasant flavor can be imparted to the milk by the mother or wet-nurse eating onions, turnips, cauliflower, or cabbage.

DISTURBANCES DURING MATERNAL FEEDING.

Quite frequently we meet with gastrointestinal disorders in infants that are wholly breast-fed. These disturbances are due to (*a*) insufficient exercise; (*b*) faulty diet; (*c*) extreme nervous irritability; (*d*) menstruation while nursing; (*e*) physiological changes in the woman, causing an improper ratio of ingredients. Some of the causes just mentioned can easily be remedied. On the other hand, a very nervous woman, whose anxiety keeps her constantly fretting during the day and awake at night, will hardly be adapted for breast-feeding, and the sooner the infant is removed from such a breast, the better for the infant.

The following cases will illustrate the above conditions:—

CASE I.—An infant was nursed by its mother. The mother was extremely nervous, fretful, did not sleep at night, and nursed her child too often.

The infant suffered with colic, had greenish, cheesy stools, and did not gain in weight. Had indigestion and all evidences of intestinal colic. The physician assured me that the mother would not leave her home, and that she had had no outdoor exercise, no fresh air, and nothing but the constant worry of a sick, crying baby which she nursed as best she could. A chemical examination of the breast-milk showed the following:—

Fat	1.20
Sugar	6.50
Protein	1.70
Ash	0.18
Total solids	9.58

Under the influence of exercise and careful diet the fat was increased. In this case we alternated breast and bottle feeding, and gave the child mixed feeding. A formula of 2 per cent. fat, 5 per cent. sugar, and 1.75 per cent. protein was prescribed.

CASE II.—An infant 1 month old had been vomiting, had had colic, and was very restless. The mother was very nervous, but had an abundance of milk. From the history I learned that the child had had an explosive vomit of food, besides large quantities of gas. There were 5 to 7 stools in twenty-four hours. The bowels moved at each nursing. The chemical examination of the breast-milk showed:—

Fat	4.00
Sugar	6.50
Protein	3.05
Ash	0.30
Total solids	13.85

From this examination it can be seen that for a baby 6 months old there was an excess of fat and also a very high percentage of protein.

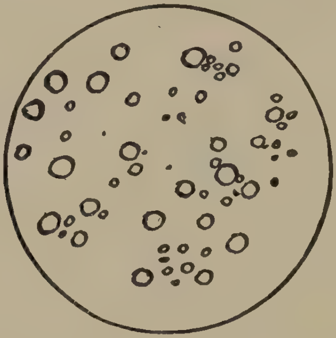

Fig. 16.—Showing a drop of milk under the microscope. Note the poor character of this emulsion, the uneven fat-globules, and their irregular size and distribution. The infant nursed with the above milk was rachitic and colicky. Although 15 months old, no tooth had appeared. The mother of the infant states that she menstruated every twenty-one or twenty-two days since her infant was born—during this present nursing period.

An infant 1 to 2 months old requires 2 per cent. of fat. Note also a normal infant receives between 1½ and 2 per cent. of protein, while this child received more than 3 per cent. of protein. There being a profuse secretion of milk, the child received

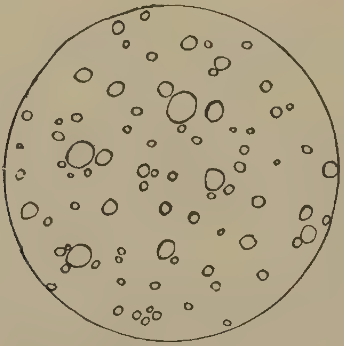

Fig. 17.—This drop of breast-milk is from a very anemic woman. The child was extremely emaciated, had greenish stools and colic, and was always crying. Note the uneven character of above emulsion, when compared with Fig. 13. The infant was poorly nourished; had rickets and marked cranio-tabes. Mixed feeding was resorted to, with decided improvement.

far more than it could digest in both quality and quantity. The feeding interval was lengthened, and the time of nursing was reduced to five minutes, whereas until the appearance of vomiting the child nursed twenty minutes. An ounce of sterilized water was ordered immediately after each nursing, hoping to thus dilute the milk. This method proved successful.

CASE III.—*A Case of Prolonged Lactation, Showing Deficiency of Nutrition.*—A child, about 1 year old, was brought to me with the following history: It has no teeth. Can neither stand nor walk. It is colicky. Does not sleep well. Does not gain weight. The child was nursed every three or four hours. The mother was very nervous, and *menstruated almost every month* during lactation. The chemical analysis of the milk gave:—

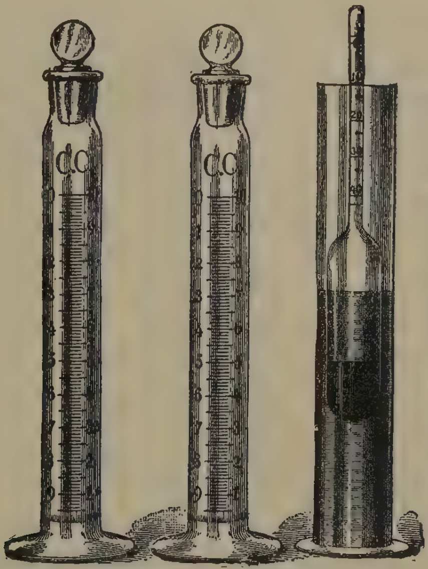

Fig. 18.—Holt's milk test set, for testing human milk.

Fat	1.22
Sugar	7.07
Protein	0.98

It was very evident that this baby was receiving poor milk, *very low fat,* and deficient *protein.* The infant was weaned, artificial feeding was prescribed, and the infant immediately showed a gain in weight. The symptoms of colic disappeared.

CASE IV.—*Illustration of Prolonged Lactation Without Apparent Harmful Effects.*—An infant 15 months old was brought to me for the relief of constipation. It had 10 teeth, was able to stand and walk, and was beginning to talk. The infant was still breast-fed. The analysis of the milk gave the following:—

Fat	2.86
Sugar	6.78
Protein	1.76

The infant's weight in this case was normal, and I must regard this prolonged lactation, showing such good results, as an *exception* rather than a rule.

ADDITIONAL FOODS DURING THE NURSING PERIOD.

Between the sixth and eighth months, if the infant is thriving and gaining in weight, cereal feeding should be added. A small saucer of farina, or cream of wheat steamed with water, for two hours, and served with skimmed milk and a small quantity of sugar, should be given before the 10 A.M. feeding. This cereal feeding may be given daily if there are no symptoms of starch indigestion, such as flatulence, colic, or distended abdomen, noted. At 12 months the yolk of a raw egg may be added to the cereal. Additional foods which may be given to an infant after the teeth erupt, or between the seventh and twelfth months, are: Two ounces of expressed beef juice over a small saucer of steamed rice; a piece of rusk or biscuit after the bottle. A coddled egg at noon may be tried when the infant is 1 year old, and if it agrees, it may be ordered every other day.

ADDITIONAL FOODS DURING THE WEANING PERIOD.

When the teeth appear, weaning must be considered. If the nursing mother becomes pregnant weaning is imperative.

The condition of the infant, its sleep, its stool and its weight are factors that should influence the decision to wean. With some infants gradual weaning may be attempted, but with most infants successful weaning can best be accomplished by the absolute cessation of the breast.

If the infant has not gained in weight, puts its fingers into its mouth, cries or whines after the breast feeding, and if the stools are watery, then weaning is imperative.

THE MANAGEMENT OF THE NIPPLES BEFORE THE BABY IS BORN.

It is very important during the last few months of pregnancy to devote considerable time and attention to the condition of the nipples. If these be found long and round, well projecting, then it is advisable to try to harden them, because the irritation from the child will cause considerable trouble unless we seek to prevent this.

Oni says that in his series of cases, one out of every two nursing women was affected with lesions of the nipples. The determining cause of the fissures was maceration of the epidermis under the double influence of the saliva of the infant and the milk which flowed during the intervals. The epidermis exfoliated and the derma exposed became excoriated; the lesion thus produced became infected, and, instead of healing, progressed in extent. The predisposing causes were short and retracted nipples and want of cleanliness. The primiparæ were affected with fissured nipples to the extent of 59 per cent.

The prophylactic treatment consists in astringent lotions during pregnancy, while after delivery the nipple should be washed with boric acid lotion before and after suction, the application of an antiseptic dressing during the intervals of nursing. The curative treatment, to be radical, consists in the suspension of nursing, which, although excellent for the mother, would be deplorable for the child. The list of agents employed against the fissure was very lengthy, indicating their uselessness.

In summer cold water will be found to be agreeable, with a small quantity of alcohol. If the nipples are very small and flat, and do not protrude properly, then suction by means of a breast-pump, applied directly over the breast, will draw them out. In some instances an ordinary clay pipe which has a smooth bowl, the bowl to be laid over the nipple and the stem to be sucked or drawn, is satisfactory. This is to be repeated every few days. A few minutes of drawing out will suffice until the nipples are sufficiently prominent. Biedert gives the following prescription for hardening the nipples:—

Tannic acid	1 teaspoonful.
Water	8 ounces.

This is to be applied after thorough washing with soap and water, and removing crusts, if they are present.

Tender Nipples.—If, while nursing, the nipples crack and blood oozes from them, or if, from irritation of the child's gums biting them, the nipple is sore, then it is a good plan to allow the child to nurse, through a nipple shield. (See Fig. 19.)

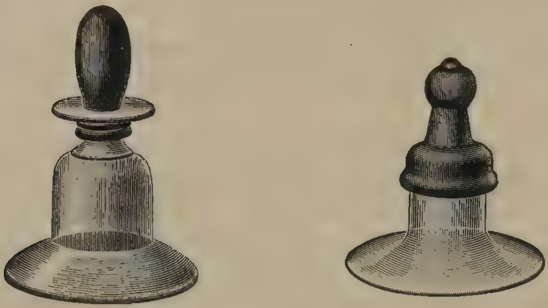

Fig. 19.—Nipple-shields for relief of tender nipples.

Nipple-shields can be used during the nursing act, and immediately thereafter the following salve can be smeared on the nipples:—

℞ Zinc oxide	1 dram.
Vaseline	1 ounce.

Treatment of Tender Nipples.

℞ Orthoform	1 dram.
Lanoline	1 ounce.

M. Sig: Apply.

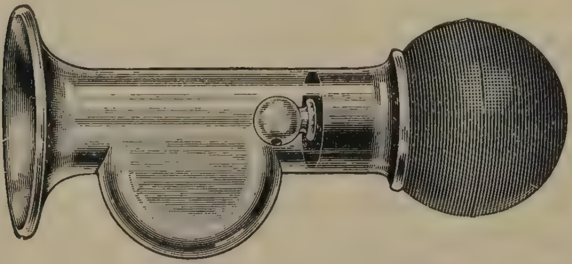

Fig. 20.—The Asepto Breast Pump.

BREAST-PUMP.

The breast-pump (Figs. 12 and 20) is a valuable addition to the nursery. It should be kept scrupulously clean by immersing it in boiling water containing a pinch of table-salt. In drawing a specimen of milk for a chemical examination the breast-pump is very useful. If an infant is ill and refuses the breast—as, for example, if it has rhinitis or nasal obstruction, interfering with breathing while the nipple is in its mouth—it will take the breast and immediately let go of it again.

In a serious condition—as, for example, in a severe case of pneumonia with loss of appetite—the life of the child may depend on forced feeding. This is described in the section on Gavage. It is very important to have the cup or any other receptacle into which we draw the milk properly sterilized; otherwise the milk will be infected in the same manner as is described in detail in the chapter on Cows' Milk and Bottle Feeding.

THE DIET OF A NURSING MOTHER.

A nursing woman should have three meals a day. These meals should be simple but nutritious.

Meat should be taken only once a day. Milk, eggs cereals, vegetables, and soups should form the principal part of the diet. Vegetables should be taken twice a day. The following are best for the nursing woman: Peas, beans, baked potato, beet and beet greens, carrots, fresh stewed corn and spinach. The spinach may be creamed or combined with egg. All varieties of fish are nutritious,—creamed halibut, creamed cod fish, fresh mackerel, blue fish, or flounder. For thirst, cool, filtered water or waters like seltzer or apollinaris water, should be taken.

Scanty Milk.—If the milk is scanty, the flow can be stimulated by drinking a cup of hot broth, weak tea, cocoa, milk, or gruel several minutes before putting the baby to the breast. Foods to be avoided by the nursing woman are: Onions, garlic, cabbage, ethereal oils and sour fruits.

Menstruation.—The return of menstruation is no contraindication to the continuation of nursing. In nearly all cases the quality of the milk will be affected to such a degree as to cause slight disturbances of digestion such as restlessness or colic, or some bowel derangement. If the baby continues to gain weight nursing may be continued. When there is colic and vomiting after the nursing diluted cows' milk may be ordered instead of the breast feeding for a few days or until the mother is normal.

INABILITY OF MOTHERS TO NURSE THEIR INFANTS.

It is surprising to note the gradual disappearance of the healthy, robust American mother who can perform the duty of nursing her infant. The following table will give a fair illustration of the conditions as they exist in New York City today:—

TABLE NO. 9.—A STUDY OF 1000 MOTHERS AND THEIR ABILITY TO NURSE.

Mothers.	Condition of Mother.	Able to Nurse 9 Months to 1 Year.	Able to Nurse 4 Days to 2 Months.	Primiparas.	Multiparas.
500[1]	Living in tenement houses. Very poor.	450	50	210	290
500	Living in healthful portion of the city. Prosperous.	84[2]	150	305	195

According to the above statistics, 90 per cent. of the poor mothers are able to nurse their children, while only 17 per cent. of the rich mothers are able to perform the same duty.

WET-NURSE.

Two important points are necessary: First, the presence of suitable milk; second, the absence of a constitutional taint[3] or acute severe illness.

What to Examine.—First, the breasts for the quantity of milk present. The breast should be gently but firmly held at some distance from the nipple; thus we can learn by palpation regarding the parenchyma of the glands. Also the quantity of milk, which, if expresssed continuously about twenty to thirty seconds, should flow in several streams.

Stagnant milk always shows sensitiveness on pressure. The statement of a wet-nurse that her "milk is deficient in quantity" can be determined by subjecting her to careful observation for several hours. After this time the milk in the breasts should be expressed and the quantity determined.

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[1] Thirty-five, or 7 per cent., of these mothers suffered from puerperal disease, such as septicemia, mastitis, and kindred affections; hence, they were ordered by their physicians not to nurse.

[2] Three hundred and twenty-four infants were put on artificial feeding. This feeding consisted of feeding at the laboratory and home modifications. One hundred and fifty-four of these infants were supplied with wet-nurses, owing to loss of weight, dyspeptic conditions, or marasmus during the bottle-feeding.

[3] The blood of every wet-nurse should be examined for a Wassermann reaction. The danger of transmitting syphilis demands this precaution.

The ease with which milk can be expressed by palpation is an important factor to note. If the milk flows with great difficulty, and requires considerable massage or pumping, then such a nurse is totally unfit to nurse atrophic, marasmic, or prematurely born babies.

Weak or marasmic children require a wet-nurse having a plentiful supply of milk, so that the slightest effort while nursing will result in a liberal flow of milk.

Note if the expressing of milk causes pain; in the normal breast it should be painless.

It is not always the quality of the milk, but frequently the quantity, that is the cause of poor assimilation of a wet-nurse's milk. In such instances a chemical examination of the milk is imperative; by this we can learn exactly how much we feed an infant in percentages. If necessary, we can modify the milk (by proper wet-nurse diet) until the required percentages are attained.

The Child of a Wet-nurse.—Certain allowances must always be made for babies presented by wet-nurses—for instance, if the hygienic surroundings of a wet-nurse are very poor, and in addition thereto her food supply is meager, then a general anemic appearance must be expected. On the other hand, a healthy, robust-looking baby must not be regarded as the criterion by which we should judge the wet-nurse.

The tricks of wet-nurses are manifold. Frequently they will procure a healthy-looking infant and pass it off as their own, in order that they may procure a position.

Another point is that they will frequently resort to stuffing their babies by feeding a bottle in addition to their breast-milk. Thus we must judge for ourselves the quality of the wet-nurse physically, and, most important of all, by the quality and quantity of her breast-milk.

Health of the Wet-nurse.—It must be borne in mind that the secretion of milk does not so much depend on her constitution as it does depend on her nervous system. Great importance must therefore be placed on the *uselessness* of hysterical or neurasthenic women for wet-nursing.

The phlegmatic temperament—the broad-shouldered, easy-going woman—pleasant and gentle-mannered, is the one most useful and best adapted for wet-nursing.

Wet-nurses with Goiter.—Bezy, of Toulouse, considers the question: Should women affected with goiter be accepted as wet-nurses? He does not think so because there is a certainty of danger for the infant, but because it is more prudent to exclude such women from nursing. He saw a fatal case of tetany in an infant aged 6 months in which no cause could be found for the disease except the fact that the mother who nursed this baby had exophthalmic goiter. A few months later he saw another case of the same kind, and he saw a case of tetany in an infant aged 3 months, who died after an illness of about forty days and whose nurse had simple goiter. Bezy thinks that tetany in infants may be of thyroid origin, and that the thyroid affections of the nurse are transmitted to the nurslings. He does not pretend to establish an invariable law, but simply wishes to call attention to the possibility of such transmission and to suggest further investigations on the subject.

We should reject a wet-nurse as unfit for nursing if she has:—

1. Enlarged cervical glands.
2. A goiter.
3. Diseased lungs, no matter how trivial.
4. Evidences of syphilis, such as a positive Wassermann reaction, or condylomata.
5. Condylomata on her genitals.
6. Mastitis.
7. Carious teeth.

Recurring menstruation is no contraindication for a wet-nurse. Some women are perfectly healthy and will menstruate regularly during their period of wet-nursing, without harm to the infant.

Erosions or fissures on the nipple should not be looked upon as contraindications for wet-nursing. Infants will thrive, although changed from one wet-nurse to another, as was demonstrated by Schlechter, who used 400 children in the Vienna Foundling Asylum. Among these an epidemic of gonorrheal ophthalmia developed, requiring isolation. Several nurses were ordered to be isolated with these infected children, and it was noted that these children developed just as well in spite of the change from their previous breast-milk.

The mortality in this same institution resulting from feeding with sterilized milk has been entirely done away with since the introduction of wet-nursing.

Finally, it is important to note that it is the quality of milk, rather than the quantity, which determines the value of breast-milk.

When children are strong and well-built, and have a ravenous appetite, they *require a slow-flowing breast-milk,* as a rapid flow of breast-milk, aided by a hearty appetite, will tend to overload the stomach, and is one of the reasons for dyspepsia in young children.

It is a good point to try to secure a wet-nurse suckling a child about as old as the one we wish her to nurse, although it is quite common to find nurses who have older children than the one they wish to nurse, and to find the latter doing well.

The proof of the usefulness of the wet-nurse is the condition of the baby after some time. If the child thrives it will increase in weight. Hence scales must be frequently used. The milk should be examined by a chemist to determine the percentage of ingredients.

Especial note should be made of the percentage of fat and proteins.

If a very quick examination is required, then a microscopical examination of 1 drop of middle-milk will show the character of the fat globules.

The rough method of examination is useful when the life of the infant is at stake and it is necessary to determine quickly whether or not a given wet-nurse is suitable for an infant. If a baby suddenly appears colicky or does not gain in weight while wet-nursing, then a chemical examination of the breast-milk is imperative. We can frequently find an excess of fat or, more often, an excess of protein as the cause of colic.

Von Bunge presents the results of an investigation in which he shows that the increasing inability of mothers to nurse their infants is a matter of inheritance.

He concluded from his figures that inability to nurse is largely a matter of inheritance. Further inquiries also led him to believe that tuberculosis and nervous diseases were to a considerable extent associated with inability to nurse one's offspring. But much more prominent appears to be the relation of intemperance. Where the mother and daughter were both able to nurse he found that the fathers were usually at least moderate in the use of alcohol, and only in 4.5 per cent. were they hard drinkers. On the other hand, when the mother was able to nurse, but the daughter was unable, it was found that the father was often intemperate, and in 46.8 per cent. was an actual drunkard. In this inquiry the author considered those only as able to nurse who could nurse all their children for a period of nine months. All others as unable.

The control of wet-nurses was very adequately discussed[1] as a public prophylaxis. Many believed it was a matter that could be brought under the control of the law.

Petrini, professor at the University of Bucharest, prepared an elaborate report in which the prevalence of infection of syphilis by means of wet-nurses was demonstrated. He showed that its frequency varied widely in different countries, and hence an English view, for instance, of its comparative unimportance, drawn from the rarity of the infection in that country, was not a criterion for the whole, since it had been shown for Oriental lands, and even for Paris, that it was an important element.

He proposes a special medical service, working in co-operation with municipal authorities and having for its head a competent syphilographer. All children being nursed by wet-nurses should be inspected regularly by representatives of this bureau, and all wet-nurses should receive authorization for their calling by the same bureau after rigorous medical examination. Special provision should be made for syphilitic children.

In New York we are at a decided disadvantage regarding wet-nurses. As no licensed agents exist, a few people procure wet-nurses from superintendents and house physicians of hospitals where obstetrical work is done.

The importance of properly supervising wet-nurses in the light of the danger of transmitting syphilis needs no further comment. The Health Department in every city should grant the use of its laboratories for a careful blood examination of each and every wet-nurse. It is as important to prevent the transmission of syphilis to a child as it is to give an immunizing dose of antitoxin to prevent diphtheria.

Being positive that the blood of the wet-nurse is not diseased, our next examination should be of the milk. A wet-nurse whose milk contains colostrum corpuscles should be rejected until the colostrum corpuscles have disappeared. The chemical examination of the milk should be made to ascertain the percentage of fat. Milk that contains more than 2 per cent. of fat should not be used. If the wet-nurse selected has an exceptionally large quantity of milk and is otherwise healthy, then the milk, if it contains too much fat, may be pumped off with a breast-pump and diluted with water, and so fed from a nursing bottle.

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[1] Second International Conference for the Prevention of Syphilis and Venereal Diseases, held at Brussels, Belgium, September 1 to 6, 1902.

It is a pity that we have no municipal control for what the writer considers one of the most valuable adjuncts to our infant-feeding, and in the same manner would regulate the supply to such unlimited numbers that modern arrogance on the part of the wet-nurse would probably disappear.

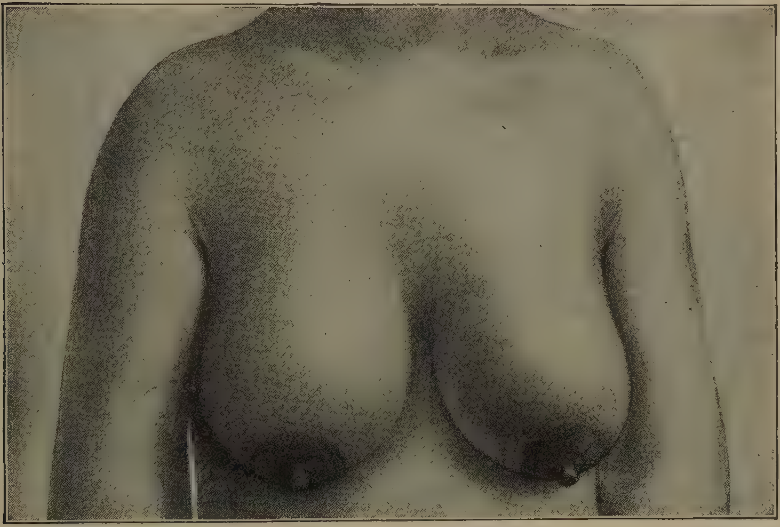

Fig. 21.—Pear-shaped breasts, best adapted for nursing.

The prices paid in New York are from $60 to $100 and board per month. This price prohibits many an infant from securing the benefits of Nature's food. Let us hope for municipal regulation.

The Babies' Welfare Federation, acting in conjunction with the Health Department in New York City, is assisting marasmic and atrophic infants whenever found by placing them in small homes with good hygienic surroundings. Whenever possible healthy nursing women are procured and sent to nurse puny infants. When it is impossible to send these wet-nurses the milk is pumped off and heated to pasteurizing temperature to insure sterility and avoid the risk of transmitting syphilis.

At the Infantorium in New York City we utilize wet-nurses to nurse atrophic infants, we also procure maternal milk for the premature infants. When such milk supply is scanty then supplementary feedings of diluted cows' milk or Dryco have given us the best results.

VI.

COWS' MILK.

FAT.

WHILE it is true that a new-born infant with a healthy stomach can tolerate a higher fat percentage than an infant with a weak stomach, great care must be exercised to avoid overtaxing the digestive functions, so that a stomach breakdown does not result.

Fat Metabolism.—The proper amount of fat that an infant can digest at birth is between 1 and 2 per cent. After several weeks 2 per cent. will be digested. Nutritional disturbances such as regurgitation and vomiting of sour-smelling liquids will follow the feeding of more fat than the stomach can tolerate. Some infants will thrive on 2½ per cent. of fat, while others demand 3 to 3½ per cent. of fat when 6 months old. The stool of excessive *fat-fed infants* will contain round *or lentil-shaped particles of fat.* Clinical experience has demonstrated that vomiting, colic, and restlessness results more often from excess of fat than from any other ingredient in the food.

Research has demonstrated conclusively that fat favors nitrogen excretion. The higher the fat, the less nitrogen will be retained. High fats usually lead to the development of soap stools. Of the total fat ingested it is estimated that 87 to 98 per cent. will be absorbed.

When we have a disturbance of fat metabolism there results a relative acidosis. Bahrdt[1] regards the soap stool as due to a smaller absorption of fatty acids, resulting from an increased peristalsis of the small intestine, which, with an increased excretion of alkali, results in the formation of the saponified stool.

The urine of an excessive fat-fed infant contains an excess of ammonia. The condition called "acidosis" results. High fat feeding results in an excess of volatile acids in the stomach and intestines. If the text-books of ten and twenty years ago are consulted the reader will find high fat feeding generally advocated. Whole milk and cream or top milk were strongly recommended for general feeding methods. That this was a fallacy has now been demonstrated. Finkelstein believes that when the fat content of the food is high, the disturbance caused thereby lessens the tolerance for sugar. Fat disturbances can be made out independent of whether the sugar content is high or low.

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[1] BAHRDT: Jahrb. f. Kinderh., 1910, 249.

Digestion of Fat.—The digestion of fat begins in the stomach and is continued in the intestine. The synthesis of the fatty acids in the fat is a function of the intestinal epithelium associated with the secretion of the pancreas and other intestinal glands. Regarding the absorption of fat, we must not suppose that all fat found in the feces is unabsorbed fat from the food. Normally the stool contains from 1 to 10 per cent. of fat, besides free fatty acids and their combinations with saponified fats. Fat is not the most important item of nutrition, because fat may be replaced by a certain quantity of carbohydrate. Whether an infant could live entirely without fat and receive in its stead a given quantity of carbohydrate has never been proven. Theoretically it is possible.

Babcock's Milk Test.—In this country the so-called Babcock milk test, invented by Dr. S. M. Babcock, has been adopted in preference to other practical milk tests, in creameries and cheese factories as well as in milk laboratories. The cause of the general adoption of this test is doubtless to be found in its simplicity, cheapness, and ease of manipulation. Briefly stated, the test is operated as follows: 17.6 cubic centimeters of milk are measured into a special milk-test bottle, an equal quantity of commercial H_2SO_4 (specific gravity, about 1.83) is added, and after mixing the two liquids the test bottle is placed in a centrifugal machine and whirled for four minutes; hot water is then added to the bottle to bring the fat into the graduated narrow neck of the bottle, and after a second whirling of one minute the per cent. of fat in the milk is read off from the scale of the test bottle.

A determination of fat in milk by this method takes less than fifteen minutes, and when care is taken in sampling the milk the reading of the result is accurate to within one-tenth of 1 per cent. Babcock testers are now placed on the market by many manufacturers of dairy supplies and at a remarkably low price, thanks to sharp competition among the manufacturers. The testers are either hand or power (steam or motor) machines and built to hold from two to thirty or more test bottles at a time.

The number of revolutions at which they must be run ranges from 800 to 1200 per minute, according to the diameter of the testers.

The Determination of Fat.—The simplest method is by the cream gauge (Fig. 22). Although its results are only approximate, they are in most cases sufficiently accurate for clinical purposes. The tube is filled to the zero mark with freshly drawn milk, which stands at a room temperature for twenty-four hours, when the percentage of cream is read off. The ratio of cream to fat is approximately 5 to 3; thus, 5 per cent. cream represents 3 per cent. fat, etc.

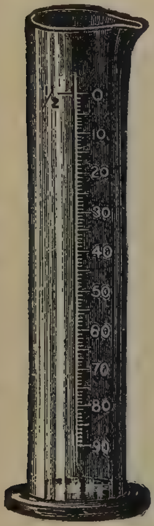

Fig. 22.—Graduated cream gauge, 10 × 1½.

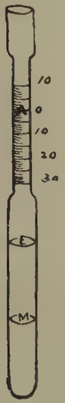

Fig. 23.—Marchand's tube.

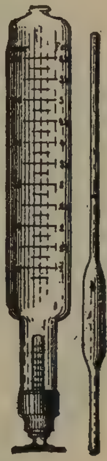

Fig. 24.—Feser's lactoscope.

Another rapid method is by Marchand's tube.

Marchand's Test.—First put into the tube (see Fig. 23) 5 cubic centimeters of milk, up to the line *M;* then 4 or 5 drops of NaOH; shake; add 5 cubic centimeters of ether, up to the line *E*. Cork, and shake fifteen or twenty times; add 90 per cent. alcohol, up to the line *A*. The tube is now tightly corked, shaken thoroughly, and placed upright in a tall bottle containing water at a temperature of 120° to 150° F. The fat separates and forms a distinct layer at the top, and after half an hour the amount is read off in degrees. By reference to the following table the exact percentage of fat is shown:—

TABLE No. 10.

Degrees, Marchand.	Percentage of Fat.	Degrees, Marchand.	Percentage of Fat.
1	1.49	13	4.29
3	1.96	15	4.75
5	2.42	17	5.22
7	2.89	19	5.68
9	3.36	21	6.14
11	3.82		

Each additional degree on the tube corresponds to 0.23 per cent. of fat. To insure accuracy the test should be repeated two or three times with the same specimen.[1]

Another test is made by the use of Feser's lactoscope. (See Fig. 24). The test is made as follows: Four cubic centimeters of milk are measured off in a pipet, put into a tube, and water slowly added, shaking from time to time until the back lines of the porcelain stem at *A* are just clearly visible through the mixture of milk and water. The percentage of fat is then read off on the glass cylinder at the level of the water added; thus, if the water is to the mark 4, it indicates the presence of 4 per cent. of fat. This test is only applicable to cows' milk.

SUGARS AND CARBOHYDRATES.

Each sugar has its specific ferment in the intestine. Maltose has maltase, lactose has lactase, and cane sugar has invertase. These sugars are all acted upon in the mouth by the ptyalin of the saliva. They are further acted upon by the diastatic ferment of the intestine and of the pancreatic juice, which transforms the polysaccharide into monosaccharide.

Before the starches and sugars are absorbed by the walls of the intestinal tract, they must be transformed by means of ferments found in the saliva, pancreatic secretions and intestinal juices.

There are two classes of sugar-splitting ferments: The "amylolytic" or "diastatic," which transforms starches into sugars and dextrins, and that known as "invertase," which, found in the mucous membrane of the small intestine and in the succus entericus, gives rise to glucose and levulose, by action upon saccharose.

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[1] These tubes may be obtained from E. Greiner, 55 Flint Street, New York.

The malted foods owe their nutritional value to the presence of dextrin and maltose. No one will question the value of the malted foods for the relief of atonic constipation. The carbohydrate seems to limit the irritating properties of an excessive fat mixture. Likewise the carbohydrate if in proper amount seems to balance improper ratios of fat and protein in artificial feeding mixtures. As a rule, 5 per cent. of the food mixture should consist of the carbohydrate element. This, however, need not be considered the point of tolerance of the infant, and the carbohydrate may be given in a gradually increased percentage. All sugars favor water retention; hence the weight of an infant will increase with an increased percentage of sugar.

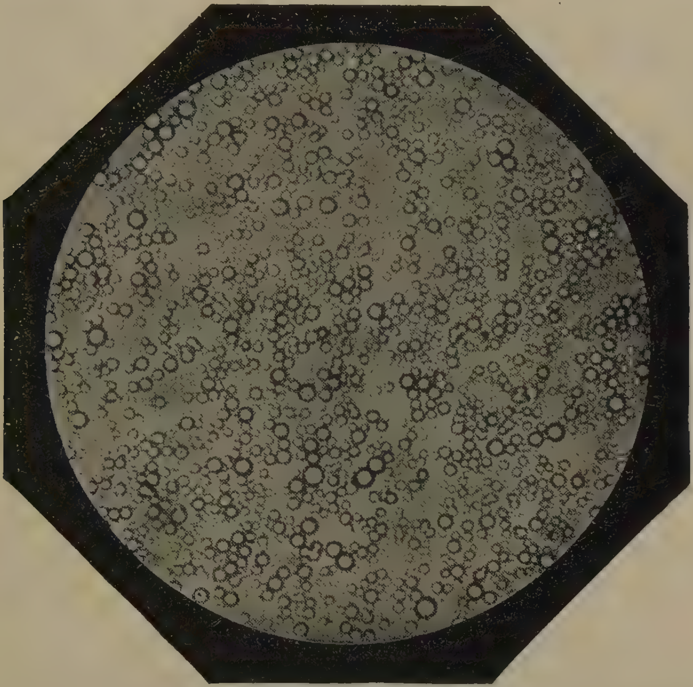

Fig. 25.—Cows' milk, showing fat-globules, magnified 330 diameters.

Malt Sugar.—According to Finkelstein, infants will tolerate a much higher mixture of maltose and dextrin than either lactose or cane sugar. The terms "maltose" and "malt sugar," as applied to the carbohydrate used in infant feeding, are inaccurate and misleading. Pure maltose is a rare product of the laboratory and is never employed in infant feeding. What is really meant is maltose and dextrin. It is of great importance that this maltose and dextrin should be derived properly (not by the acid process, but in a natural way), by the action of the enzymes of sound barley malt upon prime, full wheat. The following maltose preparations find a wide field of usefulness in the feeding of infants:—

Dextri-maltose No. 1* (with sodium chloride 2 per cent.).

Maltose	25 per cent.
Dextrin	41 per cent.
Sodium chloride	2 per cent.
Moisture	5 per cent.

Dextri-maltose No. 2 (salt free).

Maltose	53 per cent.
Dextrin	42 per cent.
Moisture	5 per cent.

Dextri-maltose No. 3 (with potassium carbonate 2 per cent.).

Maltose	52 per cent.
Dextrin	41 per cent.
Potassium carbonate	2 per cent.
Moisture	5 per cent.

Dry malt soup.

Maltose Dextrin	47 per cent.
Wheat flour	47 per cent.
Potassium carbonate	1 per cent.
Moisture	5 per cent.

In many cases of eczema all the sugars, even maltose, should be reduced or perhaps eliminated until improvement is noted.

Corn Syrup.—This can be used as a carbohydrate with milk and water instead of sugar. One teaspoonful can be given to each feeding. The bowels should be watched as the corn syrup has a laxative tendency.

Milk Sugar (Lactose).—Milk sugar causes abnormal acid fermentation. This results in symptoms of intestinal irritation due to destruction of epithelium which interferes with the proper emulsification of fats; therefore, the presence of fats acts as an additional irritant and provokes loose bowels.

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* Mead's.

When intestinal irritation exists, caused by the presence of milk sugar, the symptoms will continue even though the milk sugar has been greatly reduced, because even small quantities of this milk sugar will keep up lactic acid fermentation and consequent destruction of the epithelium.

A theoretical reason for the increase in bodily weight when feeding sugar, is that such sugar requires a certain amount of water to hold it in suspension. Large quantities of sugar have a decided influence on the temperature of the body. A rise in temperature will follow when a large dose of glucose is given, and a higher fever curve will be noted when a dose of 15 to 30 grams of lactose has been given. For older children ½ to 1 teaspoonful of milk sugar given three times a day will relieve constipation.

Cane Sugar (Sucrose).—Cane sugar is less irritating to the intestinal mucosa than milk sugar. It is easily assimilated, and for this reason has many advocates. I have seen good results therefrom. When malt sugar cannot be procured, my advice is to use cane sugar. It does not possess laxative properties. When cane sugar is used no more than 2 to 3 per cent. of the total quantity of food should be ordered.

Cane sugar is employed in commerce to preserve milk foods, which proves that this form of sugar possesses antibactericidal properties.

PROTEIN.

Under this heading we include casein and albuminoids. Protein is the most important constituent of food. To sustain life, to increase growth, to reproduce cell waste, and to develop the organism, especially muscle, bone, and teeth, we need protein. In combination with a sufficient quantity of fat, carbohydrate, and salts, the physiological development of the body takes place. The nitrogenous waste of the cells of the body can be replaced by no other element but protein. It can readily be seen that a deficiency in the development, growth, and maintenance of the infant's body depends largely on the assimilation of protein. According to Pavy, the nitrogenous compounds are mainly "histogenetic" or tissue-forming material. By the separation of urea which occurs in this metamorphosis in the animal system a hydrocarbonaceous compound is left which may be appropriated to heat production.

The protein element in milk is best adapted for infants. This animal food can be replaced only temporarily by vegetable protein. Temporary success may be noted in many varieties of feeding, especially when large quantities of carbohydrates, be they sugars or starches, are fed to the infant. When a large gain in weight is desired, then starches and sugars are indicated. Disaster will invariably result from the prolonged feeding of excessive quantities of carbohydrates if the protein is deficient. Not so many years ago, protein was regarded as the element in food causing the greatest disturbance. Cheesy, curded stools thought to be casein indigestion were later found to be fat particles, and the curded masses were proven to be saponified fats.

Further research has demonstrated that colic, eructations, and vomiting are most frequently caused by an excess of fat. What was supposed to be the harmful element and the food element mostly to be feared, namely, protein, is now proven to be the element giving us the least concern.

An excess of protein has decided therapeutic virtues and its indication in the treatment of catarrhal colitis in infancy has been established. Not more than a dozen years ago our literature warned against giving an excess of protein, and advised giving ½ to 1 per cent. in a feeding mixture. Research studies, combined with careful clinical observations, have demonstrated the fact that double the quantity of protein can easily be assimilated.

The protein molecule is peculiar when compared with the carbohydrate molecule. The toxicity of some varieties of the protein molecule due to the action of the intestinal ferments or the intestinal bacteria will be appreciated when we consider the end-results, such as fever, rash, and general prostration. These latter are often anaphylactic reactions.

There is a decided difference between the protein of cows' milk and human milk. Boggs[1] states that if a solution of phosphotungstic and hydrochloric acid are added to milk in an Esbach tube, after twenty-four hours the protein will precipitate and the amount can be read off.

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[1] Boggs: Johns Hopkins Bulletin No. 187, Oct., 1906.

When we examine the protein of human milk, we find the analysis shows:—

	Human Milk	*Cows' Milk*
Caseinogen	Small Amount	Large Amount
Lactalbumin	Large Amount	Small Amount

In woman's milk König finds the lactalbumin is about two-thirds and the caseinogen about one-third of the total protein. In cows' milk the lactalbumin is only one-sixth to five-sixths caseinogen.

As an infant grows older, its power to digest casein becomes proportionately greater. In the latter months of infancy, the tenth, eleventh, and twelfth, its proteolytic function has become adapted to this change in the ratio of the caseinogen and lactalbumin, so that the higher total protein, such as 2.50, 3, 3.50, and, finally, 4 per cent., with the relatively high caseinogen and low lactalbumin, become the proper nutritive portion for the infant.

The difference in the proteins, particularly the casein of cows' milk and human milk can best be compared as follows:

1. The proteins of human colostrum are assimilated by the new-born infant with very little change in the digestive tract. This would be impossible with the proteins of cows' milk.
2. The casein of cows' milk is easily precipitated with acids, whereas the casein of human milk is precipitated with difficulty.
3. The casein of cows' milk is precipitated in large tough curds which tend to mat together in larger tough and rubber-like masses.
4. The casein of human milk is completely dissolved by an abundance of gastric juice. This is impossible with the casein of cows' milk because of the physical and chemical properties of the large curd masses formed in the stomach.

Aside from inherent differences which may exist in the chemical constitution of the casein of human and bovine milk, a brief consideration of the difference in the physical condition of the precipitated casein of these two milks, will readily reveal why human milk is more easily digested than cows' milk, and also why cows' milk, after processing or drying in a manner which changes the condition of the casein so that it simulates that of human milk, is likewise more digestible than the natural raw milk. This desirable result is obtained when milk is dried by the Just double-roller process.

ALBUMINOIDS IN COWS' MILK.

That there are differences in the amounts of the albuminoids occurring in human milk is proven by the fact that, while Leeds found a variation of 0.85 to 4.86, Meigs asserts that there is generally but 1 per cent.

König, an earlier analyst, makes the variation from 0.85 to 4.86. Some of these results give as high a percentage of albuminoids in woman's milk as we find in cows' milk, and I have no doubt in my own mind that the time and habit of extracting the milk has a great deal to do with the amount of occurring albuminoids. In other words, when milk is extracted every two hours or less, it cannot contain as much of the cell-material as milk from the same source extracted at intervals of twelve hours. This latter is riper, and it is the non-conformity of the tissue which causes all the difference in the different occurring albuminoids. We know that during the incubation of eggs casein is developed from egg-albumin. This illustrates the ripening of albumin. Furthermore, if you take an egg just laid by the hen, and boil it, you will find immature albumin in it, that is, after boiling, instead of being thick and firm, like an older egg, much of it is milky. If boiled a few hours later, all the albumin will coagulate perfectly, because it has had time to ripen. There is no doubt that the albuminoids in milk from healthy animals are all cell-transformations, not an exudate, as are undoubtedly the fats and salts, because these latter we can influence by the food very plainly, but in health the albuminoids are constant without regard to food, while during menstruation, pregnancy, and other conditions, notably febrile disturbances, we find the fats and salts not materially affected, but the albuminoids decreased, increased, or totally changed, as in the case of colostrum. *The casein, besides being riper in cows' milk,* by reason of its stronger growth, is intended by Nature to coagulate into a hard mass, because it is the product of a cud-chewer for the nourishment of a cud-chewer, and the reason why it does not always coagulate in the infant's stomach as it does in that of the calf is that the latter animal's stomach secretes a principle called *chymosin.* This is the principle that curdles cows' milk, and it operates either in an acid or an alkaline medium. *Pepsin will not coagulate milk,* and hence the *hard coagulum of cows' milk* that sometimes forms in the infant's stomach is due to *acidity of that organ,* and this acidity is not always the fault of the stomach, *but of the milk itself.* The variations in the chemistry of the albuminoids found in cows' milk would not be surprising to anyone if he would examine into the condition of some of its mammary sources. Thus it will often be found, on *dissecting a cow's udder,* that there are *old cicatrices,* one or more quarters of the udder intensely inflamed, sometimes a mammiferous duct clogged with a calculus or a clot of fibrin. Besides these pathological conditions, the mammary gland is subject to benign and malignant infiltrations, bacillary tubercular deposits, and eruptive diseases of the skin involving the gland and ducts. Therefore, that fibrin, serum, and albumin, in various forms, are found in the cows' milk is not surprising, and it can safely be assumed that any variation in the albuminoids from the normal casein can be ascribed to sickness on the part of the animal.

Curds in Cows' Milk.—Milk curdles under two entirely distinct sets of conditions: (1) It curdles on addition of an acid, and (2) it curdles under the influence of rennet (when the reaction of the milk is either neutral or slightly acid). The two varieties of curds which may be obtained under these circumstances may be denominated "acid curds" and "rennet curds," respectively. Acid curds must inevitably be formed in the stomach after milk has been drunk, if the gastric contents are allowed to become acid. Such curds (we are familiar with them in ordinary life in the form, for instance, of cream-cheese or sour-milk) are probably not sufficiently firm to set up digestive disturbances. On the other hand, rennet curds (such as we are familiar with in the form of renneted milk and of ordinary cheese) may be extremely firm.

CASEIN.

Casein can be fed to very sick infants and will be assimilated in small or in large doses. Casein stimulates alkaline secretion; hence, acts antagonistic to pathological acid fermentation. Casein is, therefore, indicated to combat diarrhea. This teaching, based on experimental feeding, reverses our former theories concerning the dangers of giving large percentages of protein. This form of food, recommended by Finkelstein, has gained a strong foothold in many clinics abroad. It has been successfully used by me in cases of intestinal disturbance, enteritis (dyspepsia), atrophy (decomposition), and cholera infantum (intoxication).

Fever, if present, does not contraindicate the use of this food. It has a low sugar and a low salt content.

Eiweiss Milk: Albumin Milk (*Finkelstein*).—Take 1 quart or 1 liter of buttermilk. Add: 1 teaspoon of wheat flour. Let it boil up. Then let it stand until the casein curds have settled. Discard 1 pint or ½ liter of the whey.

Add:

3⅓ ounces or 100 Gms. of 20 per cent. sour cream, and
13⅓ ounces or 400 Gms. of water.

Infants with hard stools should receive Eiweiss milk with 5 to 10 per cent. of carbohydrate. They should get 3 or 3½ ounces per pound, or 180 to 200 Gms. pro kilo.

Children with *diarrhea:* with gradual or without loss of weight, should receive the above treatment.

If symptoms of dyspepsia exist give short tea interval, beginning with 1⅔ to 3⅓ ounces to 2⅕ pounds, or 50 to 100 Gms. pro kilo., increasing rapidly up to 6⅔ ounces or 200 Gms. If the weight remains stationary, add carbohydrate, disregard the condition of the stools.

All cases with *rapid loss of weight* should be treated as follows:

(*a*) Give six hours of water or tea interval.

(*b*) Buttermilk or whey soup. Buttermilk or whey with 2 or 3 per cent. of flour and no sugar. Begin with 1⅔ ounces for 2⅕ pounds, or 50 Gms. pro kilo, rapidly increasing the next few days until 3⅓ ounces or 100 Gms. are given.

(*c*) Add to the above Eiweiss milk, at least 5 per cent carbohydrate in daily increasing doses until the total amount equals, whey or buttermilk plus Eiweiss of 6⅔ ounces for 2⅕ pounds or 200 Gms. for one kilo.

(*d*) Gradually substitute Eiweiss milk for the buttermilk. One or two meals of buttermilk soup should be given, owing to the danger of renewed loss of weight by sudden withdrawal.

Such method should be continued for some time. When the appetite is poor give concentrated Eiweiss milk without the addition of water, but with the addition of 20 per cent. carbohydrate.

MINERAL SALTS.*

The growth of the body requires salts. Such salts are found in human milk and in cows' milk; thus, calcium, phosphorus, and magnesium necessary for bone building form a large part of the ash. Cows' milk contains more than twice as much potassium, five times as much sodium, phosphorus, and calcium, four times as much magnesium and chlorine, and six times as much sulphur as does human milk.

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* I am indebted to Raymond Hoobler for many points in the preparation of this article.

From the studies of Blauberg, Soldner, and Hoobler, we note that the ash intake in artificially fed infants is six to nine times greater than that of breast-fed infants.

Calcium.—Of the ash in human or cows' milk one-fifth consists of calcium. It usually enters the body in organic form. The organic combination is present in milk, yolk of egg, and vegetables. Calcium is the largest mineral constituent of the body. It is present as calcium phosphate, which makes up a large part of the bone salts. Jacques Loeb, and Blauberg have shown that infants who cannot metabolize calcium cannot survive.

The calcium intake in cows' milk feeding is about eight times greater than in human milk; the amount actually absorbed and retained is four times greater on cows' milk than on human milk. However, a much larger percentage of human milk calcium is retained. It is evident, therefore, that the calcium of human milk is much better metabolized than the calcium of cows' milk, and, since a healthy nursing infant shows no signs of a deficiency of calcium, we may well consider the amount which it gets as being the true calcium need. The absorption of calcium depends in part on the presence of accompanying salts; for example, if much alkali bases are present in the intake the absorption is diminished, whereas NaCl assists in calcium absorption. Calcium is more readily absorbed on flesh than on a vegetable diet.

Human milk and cows' milk contain very small quantities of iron. Were it not for the large amount stored in the liver and blood of the new-born there would be a deficiency in the early months of feeding.

The organic forms occur in the nucleoalbumins, in milk, yolk of egg, and in many vegetables.

Phosphorus.—Organic phosphorus occurs in milk, eggs, and legumes. As an organic combination it is found as nucleoalbumin, nuclein, vitellin, casein, and lecithin. The nucleins make up 41.5 per cent. of the total phosphorus of human milk, while in cows' milk only 6 per cent. is in that form. In human milk 35 per cent. of total phosphorus is in the form of lecithin, while the lecithin of cows' milk is but 5 per cent., according to Stocklasa.

Sodium and Potassium.—It should be remembered that both alkaline and acid solutions exist within the same body; that the blood, various secretions, as well as each body cell, have a definite amount of alkali, and can vary only within very narrow limits, in order that they may perform their proper functions. This automatic regulation of alkalinity of the tissues and fluids is one of the marvels of the human mechanism, and it is remarkable how rarely it varies sufficiently to produce a pathological condition. It is for the maintenance of this stupendously important work that the fixed alkalies, sodium and potassium, are used. Albu and Neuberg[1] have explained this self-regulation thus: Through the tearing down of the albumin of the body and the albumin taken in in the food, sulphuric and phosphoric acids are set free and must be neutralized by the alkalies of the blood. These acids would draw out the fixed alkalies were it not for the supply of carbonate derived from the carbonic acid and from the vegetable salts taken in the food. At certain times when the breaking down of albumin is excessive, ammonia is also set free and this is used along with the carbonates for the fixing of the acids. By means of this sort of neutralization, the acids become a constituent of the body, the fixed alkalies remain untouched, and the alkalinity of the tissues is unchanged. Should this reaction suffer the least change, either through a lessening of the bases or an increase of the autogenous acids, the organism becomes at once in danger.

TABLE No. 11.—PERCENTAGE COMPOSITION OF MINERAL ELEMENTS OF HUMAN AND BOVINE MILK.

	Human Milk Bosworth.	D. M. Co. Lab.	Bovine Milk Bosworth.	Babcock.
Sulphur tri-oxide	0.002	0.019	0.025	0.027
Phosphorus pentoxide ..	0.034	0.174	0.199	0.170
Chlorine	0.038	0.075	0.076	0.100
Calcium oxide	0.050	0.152	0.201	0.140
Magnesium oxide	0.005	0.007	0.022	0.017
Potassium oxide	0.086	0.154	0.145	0.175
Sodium oxide	0.020	0.054	0.074	0.070
Iron oxide	Trace	Trace	Trace	Trace
Total	0.235	0.635	0.742	0.699

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[1] Mineralstoffwechsel, Berlin, 1906, p. 70.

TABLE No. 12.—INORGANIC SALT CONTENT OF BOVINE AND HUMAN MILK.

Substance.	Soldner Cows' Milk (gms. per 100 c.c.).	Van Slyke and Bosworth Cows' Milk (gms. per 100 c.c.).	Bosworth and Bowditch Human Milk (gms. per 100 c.c.).
Sodium chloride	0.0962	None	None
Potassium chloride	0.0830	None	None
Mono-potassium phosphate	0.1156	None	0.068
Di-potassium phosphate	0.0835	0.230	None
Potassium citrate	0.0495	0.052	0.103
Di-magnesium phosphate	0.0336	None	None
Magnesium citrate	0.0367	None	None
Di-calcium phosphate	0.0671	0.175	None
Tri-calcium phosphate	0.0806	None	None
Calcium citrate	0.2133	None	None
Calcium oxide (caseinate)	0.0465	0.054	0.024
Mono-magnesium phosphate	None	0.103	0.027
Sodium citrate	None	0.222	0.056
Calcium chloride	None	0.119	0.059
Total	0.9056	0.955	0.337

Sodium Chloride.—Of all mineral constituents, sodium chloride has the most important function to perform. Not only does it retain but it excretes water. Because of the well-known fact that salt requires water for its retention, the *salt-free diet* was suggested to relieve edema and thereby favor excretion of water. Sulphur is found in human as well as cows' milk, but its importance has not yet been fully determined.

Hoobler concludes as follows: Salts are necessary to maintain life. They are best absorbed and utilized when in organic combination with food-stuffs. There are marked differences in the salt content of woman's and cows' milk which should be considered in artificial feeding. Certain pathological conditions arise in which certain of the salts are not absorbed, even though in abundance in the food. In certain other pathological conditions salts are actually withdrawn from the body to such an extent as to impoverish the organism and produce grave disturbances of nutrition. The various salts, with the exception of iron, are present in sufficient quantities and proper proportions in human milk. In most of the dilutions of cows' milk there is an excess of salts, which may be neglected in feeding normal infants, but which plays an important rôle in the feeding of children already suffering from nutritional disturbances. The conditions under which the salt content of feedings should be altered, and in just what degree each or all should be varied, are still unsolved problems.

VEGETABLE SALTS.

Vegetables contain the earthy salts and are necessary for growth. The mother liquor of vegetables is the most nutritious portion and contains the salts which aid in the metabolism of food. While some authors advise orange-juice as an antiscorbutic my own experience has shown me that carrot-juice is preferable both as an antiscorbutic as well as to stimulate digestion both of fat and protein.

The nutritive value of vegetables in infancy has not received the prominence that it deserves. Even the premature infant, less than 7 pounds in weight has been given several drams of vegetable juice daily, with excellent result. The weight curve is usually influenced thereby and one can see a sudden gain when these vegetable juices are added to the dietary. Spinach pulp forced through a fine sieve can be added to the infant's bottle, and infants 2 and 3 months of age assimilate this food and gain therefrom. While the particles of spinach pulp will appear in the stool, the earthy salts are absorbed and their effect is shown in the blood count.

Vegetable juices may be added as a diluent to each milk feeding to replace the water ordinarily used.

THE ADDITION OF LIME-WATER, BICARBONATE OF SODIUM, OR OTHER ALKALIES TO COWS' MILK.

Lime-water is the alkali usually selected for neutralizing the acidity in cows' milk. It acts by partly neutralizing the acid of the gastric juice, so that the casein is coagulated gradually and passes, in great part, unchanged into the intestine to be there digested by the alkaline secretions. As it contains only ½ grain of lime to the fluidounce, the desired result cannot be attained unless at least a third part of the milk-mixture be lime-water. Instead of lime-water, 2 to 4 grains of bicarbonate of sodium may be added to each bottle, or, better still, from 5 to 15 drops of the saccharated solution of lime.

This solution is made in the following way:—

℞ Slaked lime	1 ounce
Refined sugar, in powder	2 ounces.
Distilled water	1 pint

Mix the lime and sugar by trituration in a mortar. Transfer the mixture to a bottle containing the water, and, having closed this with a cork, shake it occasionally for a few hours. Finally, separate the clear solution with a siphon and keep it in a stoppered bottle.

Bicarbonate of Soda Solution (*Baking Soda*).—Take 1 grain of soda bicarbonate to ½ ounce of water, or 1 dram of soda bicarbonate to 1 quart of water. This is the proper strength used for diluting milk.

Quantity to be Used.—One tablespoonful of the last-named solution equals in strength 1 tablespoonful of ordinary lime-water.

Both lime-water and soda-bicarbonate solution should be kept in very clean, well-stoppered bottles and in a cool place.

The teaching that lime-water should be added to render cows' milk alkaline, and thereby resemble human milk, has been studied by Kerley, Gieschen, and Meyers, whose conclusions are very interesting. They say that:—

1. Breast-milk and cows' milk are both acid.

2. The litmus-paper test for milk is unreliable because of the variation in the quality of litmus paper, and the litmus taking part in the reaction and not acting as an indicator.

3. The effect of adding lime-water or bicarbonate of sodium to feeding is to retard or inhibit the formation of curds by rennet.

4. The teaching that lime-water, bicarbonate of sodium, or carbonate of potassium should be added to fresh milk or feedings simply because they are antiacids is erroneous.

5. The addition to milk or feedings of alkalies or salts that become alkaline in solution is an empirical method of aiding digestion by preventing the formation of dense curds that would slowly leave the stomach and be difficult of digestion in the intestine.

In one respect I do not agree with them, and that is in regard to the addition of bicarbonate of potassium. In weak infants, especially in marasmic cases and in those infants in which "milk colic" appears one or two hours after being fed with cows' milk, I have found that by the *addition* of 10 to 15 grains of bicarbonate of potassium to each feeding improvement was invariably noted. I have not found this improvement when bicarbonate of soda or lime-water was added.

VITAMINES.[1]

The word "vitamine" was coined by Funk in 1913 to express the group of as yet unidentified substances which cannot at present be classed as proteins, carbohydrates, fats, or inorganic salts. Hopkins calls them "accessory food factors"' while Lusk prefers the term "food hormones."

There are at present three clearly separated vitamines:

(1) Fat soluble or "A" Vitamine.

(2) Water soluble or "B" Vitamine.

(3) Antiscorbutic or "C" Vitamine.

Vitamine "A" is contained in butter, cod-liver oil, beef fats, egg-yolk, cod-testicle, and in milk fats, and in alfalfa.

Vitamine "B" is found in yeast, the pericarp or shell of rice and other grains, milk, and in peas.

Vitamine "C" is found in orange juice, lemon juice, potatoes, milk, codliver oil and in uncooked spinach, or carrots.

Even though a child may be getting a diet which contains a sufficient number of calories, if the food that is being fed does not contain all of the three previously mentioned vitamines, in a short while the symptoms of a deficiency disease will develop, depending upon which vitamine has been missing from the food. Thus, beriberi results when the "B" vitamine is not included, or polyneuritis may develop from the same deficiency. A lack of fat-soluble "A" vitamine results in lack of growth. Scurvy results from a lack of vitamine "C."

By supplying foods containing the missing vitamine or vitamines, these deficiency diseases can be cured.

One disease thought to be a deficiency disease, but for which no one specific vitamine has been definitely found to be beneficial in all cases is rickets. It is quite possible that rickets results from a lack of all three vitamines.

That previous diet affects the milk of cows is a well-grounded fact. If a cow eats food containing no vitamine her milk will likewise be deficient in the vitamine which she lacked in her diet. Milk poor in vitamines may well be an etiological factor in the development of rickets.

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[1] CASIMIR FUNK: Die Vitamine, Wiesbaden, 1914.

Vitamines are destroyed by heating to 65° or 70° C. It will therefore be understood why boiled milk is lacking in vitamines. Pasteurization aims to retain the vitamines and yet destroy pathogenic bacteria. In this, the method has only partially been successful. Hess reports the outbreak of scurvy in an institution where the infants were fed on milk heated to 70° C. There are however no reports in the literature of scurvy or other deficiency diseases developing when milk heated to 63° C. was used. This is the temperature recommended by Pasteur to accomplish the double purpose of destruction of pathogenic organisms and retention of vitamines. It is safest however to add to pasteurized milk a small amount of orange-juice to supply a possible diminution of antiscorbutic vitamine.

THE VALUE OF YEAST.

To justify the use of yeast one must study its efficiencies and its deficiencies and note them carefully before using the same.

Intense research during the last ten years demonstrates beyond a doubt that yeast *per se* does not measure up to its reputation.

As is well known, dried yeast contains over 50 per cent. protein, and is very rich in nuclein, the mother substance of nucleic acid. In man and the anthropoid apes the purin nucleotid portion of its molecule is metabolized into uric acid which is excreted by the kidneys. In other mammals, most of the uric acid is further oxidized into allantoin. These facts are interesting, as a possible explanation of the differences in the utilization of yeast protein by the human and animal organisms. Voeltz (1911) demonstrated dried yeast to be a nutritious, and easily digestible, feed for animals. Osborne and Mendel (1919) kept rats for more than a year on a diet in which yeast furnished the sole source of nitrogen as well as the antineuritic vitamine. The animals showed a normal rate of growth but certain cases exhibited sterility on arriving at maturity. Wintz (1916) has shown that the feeding of yeast increases the output of uric acid, and states that it is detrimental to patients with gout, and other similar diseases. Funk, and his collaborators (1916) conclude from a series of metabolism experiments on four normal men that the value of yeast to supply the protein requirements of the entire body is slight. A considerable amount of yeast is not utilized and passes out in the feces, while assimilation of the remainder is followed by a rise in the uric acid content of the blood.

Further evidence that the protein of yeast is not an ideal food for man is furnished by the experience of Germany during the World War. Yeast was cultivated in media consisting of inorganic salts and glucose as a means of manufacturing protein. According to Robertson (1920) the protein was utilized as a concentrated feed for cattle but not to any extent as a food for man.

The value of dried or autolyzed yeast should be carefully considered before accepting it as a supplement for the food deficiencies of milk in infant feeding. A brief review of the experimental data is interesting and illuminating. Only one of the accessory foodstuffs, an anti-neuritic vitamine, is contained in dried yeast or autolyzed yeast. According to Cooper (1913), Chick and Hume (1917), and Osborne and Mendel (1918) and others, yeast possesses an anti-neuritic vitamine in marked concentration. Hess (1916) showed that autolyzed yeast was of no value in the cure of infantile scurvy. Chick and Hume (1917) and Cohen and Mendel (1918) failed to prevent or cure guinea pig scurvy with either autolyzed yeast, yeast extract, or dried brewers' yeast. The British Medical Research Committee in its report on present knowledge concerning accessory food factors (1918) states that dried yeast contains very little, if any fat-soluble "A" vitamine and that commercial yeast extract contains none.

STARCH.

Amylaceous dilutions of milk have been in use very many years. They increase the carbohydrate; besides aid mechanically in breaking up the curd into fine particles, thus rendering it more digestible. The saliva of the newly born infant can dextrinize starch. Starch is not assimilated as such, but is transformed into maltose, dextrin and glucose. These latter are suitable for the construction of tissues.

Cereals.—In the feeding of infants we should give sugar to supply the carbohydrate element in preference to starchy foods. Cereals should not be ordered until the infant is six months old or until the teeth begin to appear. Experience has shown fair quantities of starch can be digested as early as the third month.

My method has been to use cereal dilutions such as barley water or rice water to dilute cows' milk after the third month. When the infant is 6 months old it is safe to feed a small saucer of well-steamed cereal, but care must be used to avoid starch indigestion, which condition is brought about by improper cooking of cereals and by overfeeding or feeding excessive quantities of carbohydrates.

CREAM.

When food contains too little fat, or its equivalent (cream), we have fat-starvation, which is soon manifested by symptoms of rickets. One of the earliest symptoms of rickets is constipation, showing deficient muscular tone: a distinct atony of the bowel.

This can be remedied by the addition of fat or cream to the food. Some children are benefited by giving them codliver oil or butter, which supply the missing food factor.

In buying cream from small milk stores one can make a rough guess at the proportion of fat in cream by its thickness. A 50-per-cent. cream at the ordinary temperature of the room runs from a jug slowly and in a thick stream, almost like thick mucilage, whereas a 16 per cent. cream runs almost as freely as milk. This is, however, a crude way of estimating the difference between poor and rich cream. It is a very important point to know exactly what percentage of cream we are using, for such mixtures like Biedert's, in which 1 ounce of cream is mixed with 3 ounces of water, may agree very well when we use a 16 or 20 per cent. cream, but might be disastrous if we use a cream containing 40 per cent. of fat. Such infants would not tolerate this rich cream, and might have troublesome vomiting.

Cream for Home Modification.—*Ordinary Cream:* This is made by setting milk at night and skimming it in the morning; it is called gravity, or skimmed, cream, and contains 16 per cent. of fat.

Twelve Per Cent. Cream.—Obtained in the city by using equal parts of ordinary (20 per cent.) centrifugal cream and plain milk. In the country we must use two parts of ordinary skimmed, or gravity, cream (16 per cent.) with one part of plain milk, or by taking the top layer of milk, after it has stood five or six hours, by means of siphoning.

Eight per cent. cream is obtained in the city by diluting one part of centrifugal (20 per cent.) cream with three parts of plain milk; in the country, by using one part gravity cream and two parts of plain milk, or by using the top layer of milk that has been standing five or six hours, and siphoning it off.

TOP MILK.

It has been shown previously that the percentage of fat in human and cows' milk are about the same, that the quantity of sugar is rather low in cows' milk, and that the quantity of casein and albumin is greater in cows' milk, as is also the ash.

Experience has shown that cows' milk must be diluted before it can safely be fed to infants. Simply diluting the milk reduces the percentages of fat and sugar too much, so that the practice of adding cream and sugar has arisen, but the processes that have been advocated for obtaining the additional quantities of fat and sugar have been too complicated for general use.

The top 9 ounces of a quart of milk on which the cream has risen will be about three times as rich in fat as the whole milk, the top 15 or 16 ounces will be about twice as rich as the whole milk, while the other ingredients remain about the same as in whole milk.

For babies under 3 months of age the top 9 ounces of a quart of milk on which the cream has risen should be diluted from three to ten times and 1 part of sugar added to 25 parts of food.

For babies over 3 months of age the top 9 ounces of a quart of milk on which the cream has risen should be diluted two or three times and 1 part of sugar added to 25 or 30 parts of food.

For babies 6 to 9 months old the top 20 ounces of a quart of milk on which the cream has risen should be diluted one-half to one time and 1 part of sugar added to 50 parts of food. An even tablespoonful of granulated sugar equals half an ounce.

By following this method the infant commences on weak mixtures that show about the same composition and variations as human milk and gradually takes food richer in casein until plain milk is reached.

The diluents used are water, gruels, or dextrinized gruels, which are simply ordinary gruels the starch of which has been converted into soluble forms, leaving the cellulose and proteins of the cereal in a finely divided state. The effect of the different diluents will be mentioned further on.

The indiscriminate feeding of cream, to strengthen the baby, cannot be too strongly condemned. Many a dyspeptic owes his trouble to overfeeding by a too good mother or nurse. When cream is added, and the proportion of fat or protein is too large, vomiting will result. Feeding delicate children with cream, regardless of their digestive power, cannot be too strongly condemned.

LIQUID, CONDENSED, AND DRIED MILK.

For infant feeding human milk is much more desirable than any substitute which can be offered, but as is well known, cows' milk replaces human milk to a large extent as an infant food. This extensive use of cows' milk has been made possible by the evolution of the milk industry in meeting demands of the public for a more wholesome product. Private and public agencies having recognized the great perishability of liquid milk and the dangers often accompanying the feeding of such milk to infants, have incorporated in the milk industry of today, practices designed to furnish the public with a highly wholesome product possessing the maximum keeping qualities which the nature of the particular product allows.

The methods which have been used in an effort to attain these results have been improvements in sanitary conditions on the farm, clarification, pasteurization, refrigeration facilities during storage and transportation, and municipal regulations of a varying nature. These factors apply particularly to liquid milk. In the condensing and drying of milk other preservative principles are made use of, with resulting differences in the physical and chemical properties of the final product. In the process of condensing milk use is made of the preservative principles of increased concentration and of heat.

Condensed milk products appear in the market as sweetened condensed, to which about 16 per cent. cane sugar is added before concentrating; unsweetened condensed, and evaporated milk. The first mentioned product is largely used as an infant food, whereas the last two are used to a much less degree for this purpose. In the manufacture of condensed milk, either sweetened or unsweetened, the processes are quite similar. The milk, prior to condensing is forewarmed or heated to 180° to 200° F. for five or ten minutes, or even longer in certain instances. Under certain conditions the milk may be even boiled for a short period. In the manufacture of the sweetened product the sugar is added at this stage. After the preliminary heating the milk is condensed in a vacuum at a temperature usually between 130° and 140° F.

RAW MILK.

Research has for many years favored the use of raw milk in the feeding of infants. It was thought that the lactalbumen was more soluble, more easily digested, and most important of all, that the vitamine content so necessary as an antiscorbutic was present in raw milk and was destroyed when milk was heated.

The danger existing in raw milk is due to the fact that pathogenic bacteria thrive therein and the risk of infection chiefly with typhoid, tubercle, and other infectious bacteria is sufficient reason for advocating the use of pasteurized milk or even sterilized milk. The vitamine content so necessary, and which is destroyed in the heating process can be added by giving supplementary feedings such as orange-juice or spinach juice.

Recent studies by Bergeim, Evvard, Rehfuss, and Hawk[1] have shown that raw whole cows' milk forms a large hard curd, whereas boiled milk curds in a much finer and softer form, that the presence of much cream (milk fat) in the milk insures the formation of particularly soft curds which are slow to leave the stomach; that skimmed-milk yields a particularly hard curd due to the absence of fat; that pasteurized milk shows smaller curds than the raw whole milk but larger than the boiled whole milk; that cold milk coagulates more slowly than warm milk, and that milk drunk very slowly, or "sipped," curds in larger curds and leaves the stomach more slowly than similar milk drunk very rapidly.

Raw vs. Boiled Milk.—Raw whole milk in the human stomach formed firm white curds which had "rubber-like" characteristics. The maximum curd formation took place at about one hour after the milk had entered the stomach. These large curds were apparently formed through the coalescing of numerous smaller curds. At this period curds as large as a man's thumb and weighing at least 15 grams may be formed.

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[1] HAWK: Am. Jour. Physiol., vol. xlviii, 1919.

Milk which had been boiled five minutes curded in an entirely different manner. In this case the curds were small, soft, flaky and of a yellow color. The largest curds were about the size of a small pea. These curds left the stomach sooner and were more digestible than the tough curds resulting from the ingestion of the raw milk. Dietetically, therefore, boiled milk is to be preferred to the raw product. The boiling of milk for five minutes, as in these tests, did not materially alter its nutritive value or growth-promoting properties but may have lowered the antiscorbutic value.

Skimmed vs. Whole Milk.—Particularly tough, hard curds of large size were formed in the human stomach after the entrance of raw skimmed milk. These curds formed very quickly (one-half minute) and inside of five minutes they coalesced to form curds as large as a man's thumb. The skimmed milk curds, because of their firm, unyielding character, were more difficult to regurgitate than were the whole milk curds. The regurgitator also complained of a "heavy" feeling in his stomach soon after drinking the skimmed milk.

Influence of Milk Fat on Curd Formation.—As a general rule the character of the milk curds was influenced in a very direct way by the fat concentration, *i.e.,* the more fat the less curd. Not only was there less total curd formation but the curds which were formed were smaller and softer the higher the fat concentration. In fact, when 40 per cent. cream was drunk no curds were formed during the first half-hour and even then the largest curds were only about the size of the head of a pin, and they did not coalesce to form larger curds as was the case in milk of low fat content.

Influence of Pasteurization on Curd Formation.—Pasteurizing of milk is not nearly as effective as boiling in altering the type of curd formation. The curds from pasteurized milk were larger than those from boiled milk, but not so large as those from the raw, whole milk. In short, the curds of the pasteurized milk were intermediate in character between the curds of raw and boiled milk, but had a tendency to resemble more closely the curds of raw milk. There was, however, less tendency for the pasteurized curds to coalesce with the formation of a large curd aggregate.

BOILED MILK.

Pediatrists have advocated the use of sterilized milk for many years. Sterilization destroys live factors in milk, chiefly the antiscorbutic element, and the other vitamines. By boiling the milk and allowing it to cool a thick skin forms which can be removed. This skin consists of lactalbumen and is one of the sources of protein irritation in many children.

Boiling destroys pathogenic bacteria. But this destruction nullifies enzymes and vitamines which are indispensable to normal metabolism. When such objections to boiling the milk were found, and as the object in question was chiefly to destroy the pathogenic bacteria, heating to 167° for twenty minutes, and still later heating the milk to a temperature of 140° for twenty minutes was found sufficient to destroy the bacteria without altering the chemical nature of the milk.

Time has proven that pasteurization does not accomplish all that we believed it would and the vitamine factors must still be fed in the form of orange-juice, tomato juice and carrot juice to supply the deficiency of the vitamines caused by heating the milk.

The experiments previously cited demonstrate that while boiling the milk does destroy the vitamine and produces changes in the lactalbumen it renders the casein more digestible and gives a finer and more flocculent curd which the infant digests more readily.

When milk is pasteurized we seek to destroy the tubercle bacillus, the typhoid bacillus, the cholera bacillus, and most of the ordinary bacteria usually found in milk. To accomplish this it is necessary to heat the milk at 145° F. for twenty minutes. Even though the milk is heated for 30 minutes at 145° F., there still remains the same proportion of soluble albumin as we find in fresh milk.

When milk is pasteurized its composition is not changed. The vitamines are not destroyed even though the milk is heated to 150° F. for 20 minutes.

When the source of the milk supply is unknown then the milk must be pasteurized, and if it is loose milk, or is sold direct from the can, then it is safer to scald the milk or heat it until it boils.

When milk is heated only ten minutes to 176° F. no soluble albumin remains while in fresh milk about 0.375 per cent. is found.

Milk being an excellent culture medium for pathogenic bacteria, it is safer to advise steaming in all cases for 20 minutes at a temperature of 140° to 150° F. It must not be inferred, however, that boiling the milk is harmful. Recent research has demonstrated that the curds of boiled cows' milk are fine and small, whereas the curd of raw milk found in the stomach after the same interval of time is coarse and rubbery. Even though the vitamine is destroyed during the boiling, the deficiency can be supplied by giving orange-juice and tomato-juice.

VII.

HOME MODIFICATION OF MILK.

GENERAL RULES OF BOTTLE-FEEDING FOR NORMAL INFANTS.

No set rule can be given for all infants. Each infant's desires must be studied. The stomach capacity of one infant may be 6 ounces at the age of two months, while another equally healthy infant will be satisfied with 4 ounces at one feeding.

In the home modification of milk our aim should be to give a simple formula, and one that can be easily understood by the mother or nurse. These formulæ, with specific directions added, should be written out by the physician, and the following conditions noted: The weight of an infant to be taken when a new formula is given; the character, color, and frequency of the stool to be noted; constipation or diarrhea supervised; sleep and general comfort inquired into. Does the infant appear satisfied after its feeding, or does it put its fingers into its mouth and whine after each feeding; does it draw up its legs, is it flatulent; is there vomiting after each feeding, and is there frequent eructation? These are questions to be answered by the mother.

Summary.—If the food agrees the infant should be comfortable, have one or more natural stools in twenty-four hours, sleep at least four hours at one time, and gain in weight from 4 to 8 ounces during the week.

The following utensils are required for the home modification of milk:—

Two-quart pitcher, Funnel, One large spoon,	glass or porcelain.

One dozen 4-ounce bottles (later substitute 8-ounce bottles).
One dozen anticolic nipples.
One box non-absorbent cotton.
One saucepan (for heating milk).
One high saucepan (for warming bottles before feeding).

FEEDING-BOTTLES.

A proper feeding-bottle is one that has no corners or angles on the inner surface. The bottom should be rounded, so that every part of the same can be properly cleaned. Bottles that have corners and grooves will harbor bacteria.

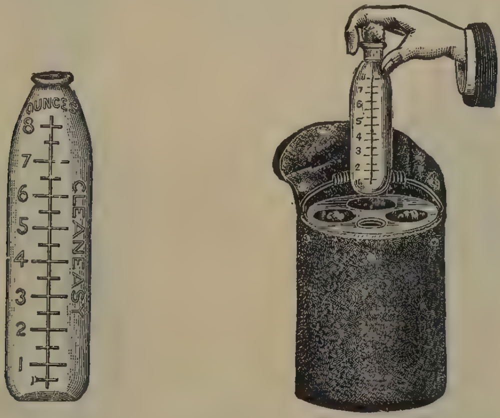

Fig. 26.—Feeding-bottle and bottle warmer. A convenient bottle warmer, adapted for keeping the night feeding warm, is here illustrated. It is made by the Arnold Sterilizer Co. It is also useful when travelling.

My preference has always been for two kinds of bottles: 1. Those holding 4 ounces and graduated on one side in both ounces and tablespoons; this saves much time and trouble. 2. Bottles holding 8 ounces and divided off into 16 tablespoonfuls or 8 equal ounces.

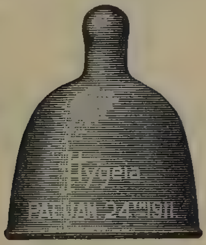

Fig. 27.—Hygeia nipple.

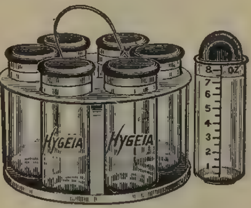

Fig. 28.—Hygeia bottle.

The Hygeia bottle and nipple have proven satisfactory to me.

Exactness of Ounces.—It may not be out of place to ask each physician to insist on having the graduated ounces on an infant's feeding-bottle measured with an *accurate graduate,* obtainable at every drug store. In many instances the author noted feeding-bottles wherein the ounces indicated were very unequal, and one particular bottle, graduated to 8 ounces, held 12 ounces.

Long Rubber Tubes.—Most pediatrists agree that the long rubber tubes are a convenient place for harboring micro-organisms, and they have been universally condemned.

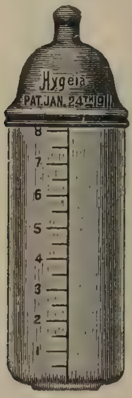

Fig. 29.—Hygeia bottle and nipple.

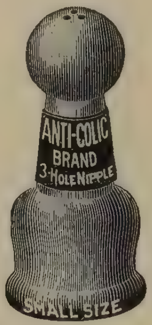

Fig. 30.—Anticolic nipple.

Care of the Bottle.—Every bottle should be thoroughly cleaned with a brush and a solution of baking soda and water, a teaspoon of soda to a pint of water. The bottles must then be thoroughly rinsed with clear water. If milk has fermented or if some residue adheres to the bottle and the same cannot be properly cleaned, then boiling the bottles will be necessary. In general and for daily use the bottles need not be boiled every day.

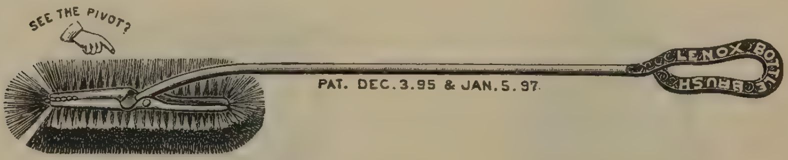

Fig. 31.—Bottle brush.

Proper Time for Cleaning Bottles.—The best time to clean a bottle is immediately after the baby has been fed; this prevents the milk souring in the bottle, and it is very easily cleaned.

The bottle brush has a long handle and bristles for cleansing the bottles. This brush should be used before the bottles are put into the soda solution. The *brush can itself harbor bacteria* and particles of milk removed while cleansing. It therefore must be thoroughly boiled in a soda solution after each use.

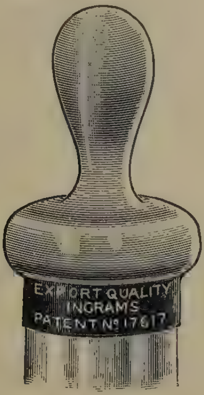

Fig. 32.

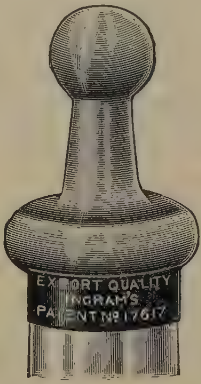

Fig. 33.

Transparent seamless nipples.

Choice of a nipple is another important matter. My preference has always been for a black-rubber nipple, and it is a very wise point to use a nipple no longer than one week; in other words, old, worn nipples are useless for the proper management of infant-feeding. Black rubber is softer than white rubber. Nearly all white

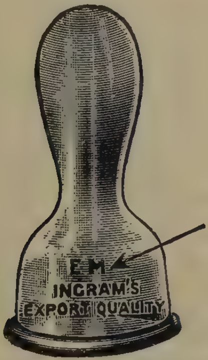

Fig. 34.

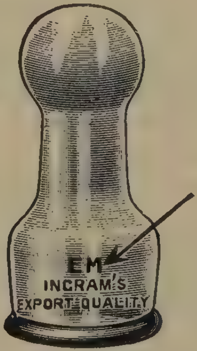

Fig. 35.

Transparent seamless nipples.

rubber is supposed to contain lead, which is a decided reason for not using it.

Nipples Recommended.—One of the best nipples made is the so-called anticolic nipple. This nipple has a ball-shaped top, which enables a baby to take a firm hold; it has three small holes, which give an easy flow of milk, and regulate a slow meal. Nipples having very large openings, which will permit a baby to finish a 6- or 8-ounce bottle of food in five or six minutes, are useless, and *this gulping of food is really the cause, or one of the causes, of infantile colic.*

The illustrations on page 91, demonstrate other types of excellent nipples. In difficult feeding cases, some children will suck the kind of nipple as shown in Fig. 32, while a smaller infant will prefer Fig. 33. Figs. 34 and 35 are adapted for normal feeding cases.

Cleaning the Nipples.—The prevention of stomatitis and mouth affections depends upon proper hygiene of the nipple. It does not require much time or trouble to remove the nipple from a bottle *and throw it into boiling water immediately after using,* wrap in sterile cheesecloth, and keep in a covered jar. A nipple thus treated is properly sterile.

DIET FROM BIRTH TO ONE YEAR.

The weight and not the age is the determining factor in prescribing food. The average number of calories required in feeding *normal* infants is 40 to 50 calories per pound during the first three months, from the third to sixth month 40 to 50 calories, and from the sixth to the ninth month 35 to 40 calories.

To sustain life during the first six months 30 calories would be sufficient. These figures do *not* apply to *subnormal* or *premature* infants, the latter require a much larger number of calories.

In using concentrated feedings it is necessary to give one or more ounces of water between feedings.

My experience at the Infantorium with dyspeptic and marasmic infants, and cases of decomposition has taught me that some infants will not gain until they have had 70, 80, 90, or even 100 calories to the pound. They require large percentages of carbohydrates, before any appreciable gain is noticed.

Whole Milk-Dextri-Maltose or Granulated Sugar-water.

At Birth. Seven Pounds.

Whole milk (grade A)	10 ounces.
Water	11 ounces.
Dextri-maltose or granulated sugar[1]	1 ounce.

Heat milk and water to steaming point, steam 20 minutes, add the carbohydrate and divide into 7 feedings. Feed as much as the infant will take every 3 hours.

Ten Days.

If the infant is satisfied continue the above formula. If there is loss of weight and the infant seems hungry, gradually increase to:

Whole milk	13 ounces.
Water	12 ounces.
Dextri-maltose or granulated sugar	1 ounce.

One Month.[2] Eight Pounds.

Whole milk	16 ounces.
Water	9 ounces.
Dextri-maltose or granulated sugar	1 ounce.

Divide into 7 feedings of 3½ ounces each. Feed every three hours.

Gradually increase to:

Two Months. Nine Pounds.

Whole milk	17 ounces.
Water	11 ounces.
Dextri-maltose or granulated sugar	1½ ounces.

Divide into 7 feedings of 4 ounces each. Feed every three hours.

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[1] Either of the above carbohydrates may be used.

[2] All infants should receive 5 drops of orange-juice daily after the first month, or 2 drops of cod-liver oil once a day if constipation exists. At three months increase or double the dose of the orange-juice or the cod-liver oil. The above are added for their vitamine content.

Three Months.[3] Ten and One-half Pounds.

Whole milk (grade A)	19	ounces.
Water	9	ounces.
Dextri-maltose or granulated sugar	1½	ounces.

Divide into 7 feedings of 4 ounces each.

Feeding Schedule.

6 A.M. Bottle.
8 A.M. ½ ounce orange juice.
9 A.M. Bottle.
12 NOON. Bottle.
3 P.M. 1 ounce spinach, tomato or carrot juice, bottle.
6 P.M. Bottle.
10 P.M. Bottle.

Four Months. Twelve Pounds.

Whole milk	21	ounces.
Water	7	ounces.
Dextri-maltose or granulated sugar	1½	ounces.

Divide into 7 feedings of 4 ounces each.

Five Months. Thirteen Pounds.

Whole milk	22	ounces.
Water	8	ounces.
Dextri-maltose	1½	ounces.

Divide into 6 feedings of 5 ounces each.

Six Months. Fourteen Pounds.[4]

Whole milk	25	ounces.
Water	5	ounces.
Dextri-maltose or granulated sugar	1½	ounces.

Divide into 6 feedings of 5 ounces each.

Feeding Schedule.

6 A.M. Bottle.
8 A.M. or 5 P.M. Orange juice.
9 A.M. Cereal and bottle.
12 NOON. Vegetable and bottle.
3 P.M. Bottle.
6 P.M. Crushed zwieback and bottle.
12 M. Bottle.

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[3] A level teaspoonful of spinach pulp may be added to one feeding after the third month.

[4] At six months give, with the second feeding, 6 teaspoonfuls of wheatena or oatmeal. Thin with a little of formula from infant's bottle.

Nine Months. Eighteen Pounds.

Whole milk	30	ounces.
Water	5	ounces.
Dextri-maltose or granulated sugar	1½	ounces.

Divide into 5 feedings of 7 ounces each. Feed every 4 hours.

At nine months may also have six teaspoonfuls of fruit juice at 9 A.M., cereal at 10 A.M., four teaspoonfuls of crushed zwieback at 2 P.M., two teaspoonfuls of vegetable pulp at 5 P.M., and six teaspoonfuls of farina or arrowroot with the 6 P.M. bottle.

One Year. Twenty-one Pounds.

Whole milk	35	ounces.
Dextri-maltose or granulated sugar	1½	ounces.

Divide into 5 feedings of 7 ounces each.

At one year may have 1 ounce of fruit juice at 9 A.M., the yolk of a hard cooked egg at 10 A.M., four teaspoonfuls of crushed zwieback at 2 P.M., and eight teaspoonfuls of farina or arrowroot at 6 P.M.

FOR AN INFANT TWELVE TO EIGHTEEN MONTHS OLD.

Use Fresh, Raw Milk Warmed to Feeding Temperature.

6 A.M. Milk, 8 ounces.
Huntley & Palmer biscuit.

8.30 A.M. Juice of an orange or 1 ounce pineapple juice.

9.30 A.M. Saucer of steamed oatmeal, farina, hominy, cream of wheat, yellow cornmeal or wheatena served with milk or thin cream.
One piece zwieback, rusk or toast with butter.
Milk, 6 ounces.

12.30 A.M. One-half ounce steak or roast beef juice, baked potato with yolk of hard-cooked egg, and stewed prune pulp. Or:
Chicken and chopped noodle soup, rice with yolk of hard-cooked egg and stewed peaches.

Or:

Beef and farina or carrot soup, spinach with yolk of hard-cooked egg and stewed apricots or apple sauce.
(On very warm days give cold consommé instead of the warm soup.)

3.30 P.M. Milk, 8 ounces.

6 P.M. Saucer of arrowroot or cornstarch pudding, junket or cream cheese on biscuit. Milk.

10-11 P.M. If awake and restless, milk, 8 ounces.

(To make a hard-cooked egg yolk—Place the egg in a pan and cover with boiling water. Do not allow the water to boil after the egg is put in, but keep it hot for forty-five minutes. Cooked in this way the yolk will be formed, but mealy and easily powdered).

FROM ONE AND ONE-HALF TO TWO AND ONE-HALF YEARS.

6-7 A.M. Milk, 8 ounces.

Two pieces of zwieback, rusk or Huntley & Palmer biscuits.

8 A.M. Juice of an orange.

9 A.M. Steamed farina, oatmeal, hominy, or cream of wheat with chopped dates or figs, raw or stewed; a coddled or poached egg, or arrowroot pudding.

Crisp toast, buttered.

Milk, 6 ounces.

12.30 P.M. Beef or chicken broth[1] thickened with sago, rice or farina, clear broth with yolk of egg, or 1 ounce steak or roast beef juice.

Baked potato, spinach, carrots, peas, string beans, beets, asparagus tips or celery (all stewed).[2]

Stewed prunes, stewed figs, baked apple or apple sauce. Huntley & Palmer biscuits, graham wafers or lady fingers.

3.30 P.M. Milk, 8 ounces.

Wheatsworth cracker.

6.30 P.M. Soft-cooked egg, junket, custard, cornstarch, tapioca, or farina pudding, or cream cheese on biscuit.

Half of a sliced banana or raw scraped apple. Cup of milk or weak cocoa.

FOR A CHILD OF THREE YEARS.

7.30 A.M. Juice of an orange, or fresh fruit in season.

Yellow cornmeal, cream of wheat, oatmeal, force, puffed rice or shredded wheat with cream or milk and sugar.

Coddled egg with one strip broiled bacon.

Toast, graham or whole wheat bread with butter. Cup of milk.

12.30 P.M. Chicken or beef broth thickened with farina, rice, barley or home-made noodles, or:

One ounce steak or roast beef juice over baked potato.

Broiled lamb chop, steak, chicken, squab, roast beef, mackerel, halibut or trout.

Spinach, peas, beans, carrots, asparagus, grated corn, tomatoes, celery or onions (all boiled).

Stewed fruits or berries in season.

3.30 P.M. Unsweetened crackers with fruit jam. On cold days a cup of malted milk (4 teaspoons Horlick's malted milk to a teacup hot water) or a cup of cocoa. Warm days, buttermilk.

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[1] When fresh soups are not available then canned soups such as the Franco-American soups may be used.

[2] Fresh vegetables should be used whenever possible. Canned vegetables may be used when fresh are not obtainable.

5.30 P.M. Shredded ham omelet, scrambled egg, cornstarch or rice pudding, custard, Philadelphia cream cheese, macaroni or noodles.

Cup of cocoa or milk.

Fresh fruit in season.

Bread and butter.

FOR A CHILD THREE TO SIX YEARS OLD.

Breakfast: 7.00 to 7.30.

Orange, apple sauce, prunes, or figs.

Saucer of farina, cream of wheat, yellow cornmeal, oatmeal, hominy, or wheatena. (All cereals to be steamed in water at least two hours. Served with cream and sugar.)

If appetite warrants it—a coddled egg.

Roll, toast, or corn muffin. If constipated, bran muffin.

Cup of milk or cocoa.

Dinner: 12.00 to 1.00.

Chicken, lamb, beef, or vegetable soup, expressed steak-juice.

Calf's foot or chicken jelly, raw scraped steak, minced chicken, or fish.

Spinach, peas, beans, young carrots, beets, asparagus, cauliflower, baked or creamed potato.

Stewed apples, peaches, apricots, prunes, or berries. Sponge cake, ladyfinger, or gelatine pudding.

Water.

Supper: 5.30.

Two poached or scrambled eggs, ham or jelly omelet. Custard, junket, corn-starch or tapioca pudding.

Cream cheese.

Bread and butter.

Sliced banana with milk or raw fresh fruit.

Cup of milk, malted milk or cocoa.

FOR A CHILD WITH WEAK DIGESTION, FROM SIX TO TEN YEARS OLD.

Many children of the neurotic type have a peculiar palate. They crave a change of diet and tire easily if the same flavor is continued. I have accordingly arranged a series of diets which can be varied from day to day, so that the most capricious appetite can be gratified.

Breakfast.

Cream of wheat and cut figs, served with cream.

Soft-boiled egg.

Corn bread.

Cup of milk.

Or:

Wheatena cooked with dates, served with cream.
Wheat cakes and maple syrup.
Graham bread.
Malted milk (4 teaspoonfuls Horlick's malted milk to a teacup of hot water).

Or:

Oatmeal with cream.
Egg poached (in bouillon).
French roll.
Cup of cocoa.

Or:

Farina and seeded raisins with cream.
Broiled bacon or ham with creamed potato.
Whole wheat bread.
Cup of malted milk.

Or:

Baked apple with cream.
Hominy.
Corn bread.
Cup of milk.

Or:

Orange.
Scrambled eggs with minced tongue or ham.
Toast.
Cup of cocoa.

If constipated a saucer of Kellogg's bran may be given as a cereal, or 2 teaspoonfuls of bran may be mixed with the cereal.

Lunch.

Split pea soup.
Lamb chops.
Baked potato.
Ladyfinger and jam.
Water.

Or:

Noodle soup.
Fried halibut or fresh mackerel.
Spinach.
Baked apple with cream.
Wafers and water.

Or:

Cream of celery.
Broiled chicken, squab, or creamed chicken on toast.

Asparagus.
Prune jelly with cream.
Water.

Or:

Beef and sago soup.
Bluefish or flounder.
Young carrots.
Apple sauce.
Wafers and water.

Or:

Cream of asparagus or vegetable soup.
Broiled sweetbread or stewed tripe.
Baked sweet potato.
Angel cake.

Or:

Chicken and rice soup.
Roast beef, steak, codfish, or smelts.
Peas.
Celery.
Stewed peaches or apricots.
Wafers and water.

Supper.

Glass of zoolak or buttermilk.
Cream cheese.
Toast.
Apple or fresh fruit.

Or:

Ham omelet.
Toast.
Glass of milk.
Grapes.

Or:

Baked macaroni with cheese.
Fresh lettuce or celery with salt.
Cup of cocoa.
Imported Albert crackers.

Or:

Scrambled eggs.
Split banana baked in shell.
Saltines.
Glass of milk.

Or:

Rice pudding with almonds and raisins.
Cup of milk.
Bread with butter and jam.
Fresh fruit.

Or:

Apple or cherry custard.
Cream cheese.
Saltines.
Cup of cocoa.

Or:

Jelly omelet.
Swiss cheese.
Uneeda biscuit.
Cup of cocoa.

Or:

Cold breast of chicken.
Lettuce or celery with salt.
Sliced pineapple with cherries.
Glass of milk.

In feeding a child of from ten to sixteen years, we should remember that the child is still growing, and that his individual requirements are vegetables, cereals, fruits, eggs, fish, and meat. Instead of one egg, two may be given at a meal. Wheat bread is very nutritious; if, however, it has a tendency to constipate, then bran or graham bread may be given. Corn bread baked in the morning may be served in the evening.

DIET FOR A CHILD OVER TEN YEARS OF AGE.

Morning.

Raw fruit in season.

Wheatena, oatmeal, farina, cream of wheat, cornmeal, grape nuts, wheat flakes or shredded wheat biscuits.

Ham or bacon and eggs.

Corn or bran muffins, wheat or graham bread, rolls.

Water, milk, or cocoa.

Noon.

Chicken, beef, and noodle, mutton, and all vegetable soups.

Lamb chops, steak, roast beef, chicken, fish, raw chopped beef, lamb or beef stew.

Peas, beans, carrots, beets, potato, corn, cauliflower, or asparagus.

Celery, lettuce, tomato.

Berry pies, cornstarch, tapioca, custard, or stewed fruits.
Wheat or graham bread.
Water.

Evening.

Scrambled eggs or omelet.
Cold chicken, lamb, or ham.
Swiss or cream cheese.
Custard or sponge-cake.
Bread, butter, and jam.
Fruit.
Water, milk, or buttermilk.

DIET FOR AN UNDERWEIGHT CHILD.

To increase a child's weight, certain ingredients of the food must be modified. This will alter the general nutrition of the body and give more weight. A word of caution is necessary. Do not force the change from a light diet to a richer and more concentrated form of food too suddenly, as thereby we may overtax the digestive function and induce dyspepsia, which may permanently weaken the stomach.

To increase the weight of a child we must increase the fat content of the food. A teaspoonful of cream added to a cup of milk several times a day is indicated. If this cream is well digested and causes no disturbance we may add another teaspoonful of cream and increase in four or five days until three teaspoonfuls are added to each cup. Butter should be given liberally. It may be given on bread or potato. Sugar may be given liberally on cereals and puddings. If cereals such as farina, cream of wheat, Pettijohn, or wheatena are well borne they should be given at least once a day. They should be served with cream or butter, and sugar.

For the noon meal, puddings, such as tapioca, arrowroot, or cornstarch, may be given. Macaroni and home-made noodles are very nutritious and increase weight. Beets, carrots, potatoes, peas, beans, and lentils, are vegetables that add greatly to both nutrition and weight of the body. Omelet, pancake, sponge-cake, rice pudding, and custard, are desserts which are very nutritious and increase the weight.

Olive oil may be given as a dressing on lettuce. Cocoa, chocolate, nuts, bacon, and eggs will aid in nourishing the child.

CANDY.

Under modern conditions it is almost impossible to prohibit all candy. The child's craving for sweets is natural, but under no consideration should they be given whenever desired, but when given they should be given either with, or just after, a meal, never before a meal as they will disturb digestion and take away the appetite. Plain taffies and hard candies which are simply flavored sugar are preferred. Cream-filled chocolates and fancy candies should never be given. Pure milk chocolate, while nourishing, is hard to digest, and must be given in very small quantities only. Children under three years should have peppermints or barley sugar.

FRUITS.

Fruits, as a rule, are easily digested by most children. For very young children stewed fruits (with the exception of orange and pineapple juice) are preferable to raw, because the cellulose, or woody fiber, is softened during cooking. If covered while they are cooking very little of their nutritive value will be lost.

All fruits to be eaten raw must be thoroughly washed, even those which are peeled. They must be neither under-ripe nor over-ripe. The banana contains more nourishment than any other fruit, and contrary to the popular belief, is not indigestible. Most children of three years can digest them perfectly. But a banana is not ripe until black spots appear on the peel. The fruit should be peeled, then scraped of the fuzzy covering, sliced, and served with milk.

VEGETABLES.

Cook vegetables only long enough to make them tender. Starchy vegetables should be placed in boiling water. Vegetables having a sweet, mild-flavored juice such as string beans and green peas should be cooked in a covered utensil in a small quantity of water, which is served with the vegetable. Vegetables having a strong-flavored juice should be cooked uncovered. These vegetables are more palatable if creamed. Vegetables should not be salted until they have cooked ten minutes, because the salt tends to draw out the juices.

	Time for Cooking.
Spinach	30 to 40 minutes.
Lettuce	30 to 40 minutes.
String beans	30 to 60 minutes.
Beet greens	40 to 50 minutes.
Asparagus tips	15 to 30 minutes.
Grated corn	15 to 30 minutes.
Kohlrabi	20 to 40 minutes.
Carrots (young)	40 to 60 minutes.
Peas	20 to 30 minutes.

White Sauce for Creamed Vegetables.

1 level tablespoon flour.
1 level tablespoon butter or fat.
½ level teaspoon salt.
½ cup liquid (water, milk, vegetable juice or meat stock).

Boiled Spinach.—Spinach and all green salads must be carefully washed through 4 or 5 waters, or until all sand and dirt are removed. When clean, place in a double boiler, cover and steam 30 to 40 minutes, or until tender. If the leaves are old and not very juicy, one or two tablespoonfuls of water must be added. If the leaves are young and tender they will draw sufficient moisture. As the salt tends to draw out the juices it should be added when the leaves are placed in the boiler.

Spinach Pulp.—Prepare spinach as above. Chop the leaves, and force through a fine sieve or cheesecloth. Throw away the tough fiber that cannot be forced through the sieve.

Spinach Water.—To ½ pint of boiling water add 1 or 2 tablespoonfuls of well chopped spinach leaves. Cover and strain after 10 minutes, expressing the juice from the leaves.

Spinach Juice.—Scald 4 tablespoonfuls of chopped spinach leaves with 2 tablespoonfuls of boiling water. Set aside in a covered vessel, squeeze the leaves, in 15 minutes strain. Add 1 teaspoonful of this juice to one ounce of water.

CEREALS.

Cereals are made from hard grains and contain much starch. They should be cooked only long enough to make them easily digested. To steam farina several hours, as advocated by some, is unnecessary and harmful. Farina requires 30 minutes cooking. Rice can be thoroughly cooked in 30 to 40 minutes. Sift the dry cereal slowly into salted, boiling water, stirring all the while to prevent lumping. The pulverized cereals, or cereal flours, should first be mixed with cold water, then poured slowly into boiling water. Cook five minutes directly over the fire, then cover and place in the double boiler, and steam for the time required.

When the coal range is used, a very convenient way to cook the cereal is to start it cooking at suppertime and leave closely covered on the back of the range all night.

PROPORTIONS AND TIME FOR COOKING CEREALS.

½ Cup	*Cups Salted Water*	*Boiling Time*
Rice	1½	30 minutes. (steam 40 minutes).
Farina	2	30 minutes.
Rolled oats	1½	1 hour.
Hominy	2	2 hours.
Cornmeal	2	3 hours.
Wheatena	2	1 hour.
Cream of wheat	2	1 hour.

For the sake of variety and to tempt a child who is not fond of cereals, stewed figs, dates, dried currants or seeded cherries may be added just before serving or they may be cooked with the cereals.

Boiled Rice.—Rice must be cooked differently from other cereals. There is danger of overcooking and having it soggy. Add ½ cup of rice slowly to 1½ cups boiling water that has been salted. Let it boil rapidly without stirring (cover the kettle) for 25 to 30 minutes, or until soft. Then pour it into a colander to drain. Stand it in the oven, leaving the door wide open, or on a very low flame, to dry for a few minutes. This drying evaporates the moisture, leaving the rice soft and perfectly dry. Serve with bits of raw butter, or stewed fruit.

Oatmeal or Crushed Oats.—Add 1 heaping tablespoon of crushed oats and ½ teaspoon of salt to a pint of water. Stir until the salt is dissolved, and stand it on the back part of the fire over night. In the morning stand it over a hot fire, and let it boil 1 hour without stirring. Serve with chopped raw or stewed figs.

Farina.—Add ½ cup farina to 2 cups salted water, sifting it in slowly, with constant stirring. Cover, and boil slowly for 30 minutes. Serve with chopped stewed dates.

Arrowroot or Cornstarch Pudding.—Dissolve 1 rounded teaspoon of arrowroot or cornstarch in 4 ounces of water and 4 ounces of milk, add 1 teaspoon of granulated sugar and boil 10 minutes.

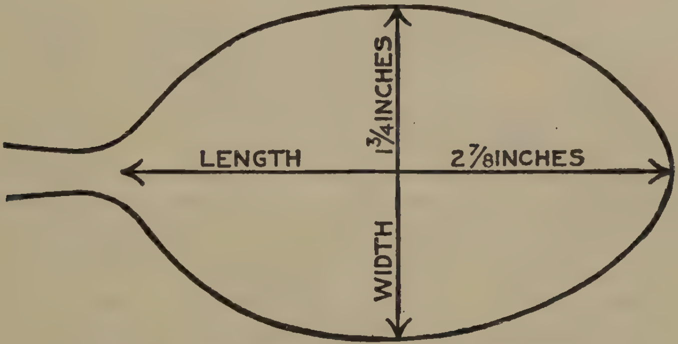

Fig. 36.—Actual width and length of a tablespoon.

May be flavored with a few drops of extract of vanilla or with a level teaspoon of cocoa or chocolate.

MISCELLANEOUS RECIPES.

Barley Water.—To make barley water add 1 tablespoonful of pearl barley to 1 quart of cold water, boil two hours, adding water from time to time. Strain through muslin and add enough boiled water to make 1 quart. When the barley flour is used mix 2 teaspoonfuls of the flour in a little cold water, add 1 quart of water and boil fifteen minutes. Strain through muslin if there are any lumps, and add enough boiled water to make one quart.

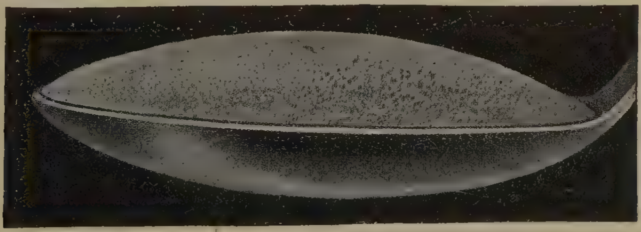

Fig. 37.—A rounded tablespoon (actual size).

Rice Water.—Rice water is made in the same manner as barley water, 1 tablespoonful of rice being used to 1 quart of water. When rice flour is used, add 2 teaspoonfuls to a quart of water.

Oatmeal Water.—Oatmeal water is made in the same manner as barley water. Use 1½ tablespoonfuls of oatmeal to 1 quart of water.

Gruel.—Gruel is made by adding 2 teaspoonfuls of rice flour, barley flour or oatmeal to 1 pint of cold water, and boiling briskly for one-half hour. Add a pinch of salt and a teaspoonful of granulated sugar.

Albumin Water.—To make albumin water add the white of 1 raw egg to ½ pint of water. Pour the egg and water into a clean bottle and shake well. Feed through a nipple or by spoon.

Nutritious Lemonade.—A nourishing drink is made by adding the juice of half a lemon to the yolk of a raw egg; let it stand for five minutes, and then add 2 teaspoonfuls of granulated sugar and 5 ounces of water.

VIII.

CALORIC FEEDING. PERCENTAGE FEEDING. PELIDISI.

CALORIC METHOD OF FEEDING.

A CALORIE is the amount of heat necessary to raise the temperature of 1 cubic centimeter of water 1° C. The determination of the heat energy expressed by a given number of calories can be applied in estimating the food requirement of infants. Most pediatrists calculate their food values in calories. My experience with this method of feeding has been very satisfactory:—

1 gram or cubic centimeter of fat equals .... 9 calories.
1 gram or cubic centimeter of sugar equals ...... 4 calories.
1 gram or cubic centimeter of protein equals .... 4 calories.

2 scant tablespoonfuls of malt soup extract = 1 ounce by weight.
2 level tablespoonfuls of cane sugar = 1 ounce by weight.
3 level tablespoonfuls of milk sugar = 1 ounce by weight.
4 level tablespoonfuls of dextri-maltose = 1 ounce by weight.
4 level tablespoonfuls of flour = 1 ounce by weight.
(Tablespoons to be levelled with a knife).

The only other figures to be remembered are the number of calories per pound weight the individual infant needs.

CALORIC REQUIREMENT OF BOTTLE-FED INFANTS.

Fat infants over four months of age....Need 40 to 45 calories per pound.
Average infants under four months of age and moderately thin infants of any age..Need 50 to 55 calories per pound.
Emaciated infants (varying with the degree of emaciation)......................Need 60 to 65 calories per pound.

The simplest method of calculating the given number of calories in a pint or quart of food is as follows:—

The caloric value of 1 ounce of 4 per cent. milk is 20; 16 times 20 calories equals 320 calories to 1 pint, or 32 times 20 calories equals 640 calories to 1 quart.

20 ounces of 4 per cent. milk 20 x 20 .... 400 calories.
12 ounces barley water 12 x 2 .... 24 calories.
1 ounce malt-soup extract .... 80 calories.
504 calories.

TABLE No. 13.—FOODS AND CALORIC VALUE OF EACH.

Food, 1 Ounce.	Caloric Value. Approximate
Cream (16 per cent.)	54
Milk (4 per cent. cream)	20
Milk (2 per cent. cream)	15
Milk (1 per cent. cream)	12.5
Milk, fat-free	10
Whey	6
Condensed milk	132
Buttermilk	10
Albumin milk	13
Malt-soup extract	80
Malt-soup (formula as given)	22
Milk-sugar (by volume)	72
Milk-sugar (by weight)	117
Cane-sugar (by weight)	117
Malt-sugar[1] (by weight)	110
Barley flour (by weight)	102.5
Rice flour (by weight)	102.5
Wheat flour (by weight)	102

To make malt soup:—

Cold water	25 parts.
Milk (4 per cent. fat)	13 parts.
White flour	2 parts.
Malt extract (Loefflund's)	4 parts.

Mix flour and water and bring to boil. Add malt extract, stirring constantly, and bring to boil. Lastly add the milk, stirring constantly. Bring to boil three times, in the mean time cooling it off quickly by standing it in cold water.

Eight level teaspoonfuls of starches or sugars are approximately 1 ounce in weight.

The formulæ on the following page are based on the studied requirements of an infant of normal body weight, which is approximately 45.5 calories for each pound weight; hence an infant weighing 7 pounds requires 318 calories in twenty-four hours.

This method is useful in controlling the feeding of infants who are not gaining in weight. We can increase the calories up to the required physiological standpoint, so that this method is in some respects similar to the percentage method advocated by Rotch and others.

Formula No. 1 (for an infant from birth to three weeks old, weighing about 7 pounds, requirement 310 calories):—

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[1] Dextrimaltose, Mead, Johnson & Co.

℞ Whole milk	10 ounces.
Water	11 ounces.
Dextri-maltose No. 3[1]	1 ounce.

Mix thoroughly and heat in a saucepan to boiling point. Divide into seven bottles of 3 ounces each. Feed every three hours. Insert corks in the necks of the bottles. Place in a refrigerator, but not on ice. Warm before feeding by placing bottle into a deep saucepan of hot water until the food reaches body temperature.

Formula No. 2 (for an infant from three weeks to six weeks old, weighing about 8 pounds, requirement 370 calories):—

℞ Whole milk	13 ounces.
Water	12 ounces.
Dextri-maltose No. 3	1 ounce.

Divide into seven feedings of 3½ ounces each. Feed every three hours.

Formula No. 3 (for an infant from six weeks to two months old, weighing about 10 pounds, requirement 450 calories):—

℞ Whole milk	19 ounces.
Water	9 ounces.
Dextri-maltose No. 3	1½ ounces.

Divide into seven feedings of 4 ounces each. Feed every three hours.

Formula No. 4 (for an infant from two to four months old, weighing about 11 pounds, requirement 540 calories):—

℞ Whole milk	21 ounces.
Water	7 ounces.
Dextri-maltose No. 3	1½ ounces.

Divide into seven feedings of 4 ounces each. Feed every three hours.

Formula No. 5 (for an infant from four to six months old, weighing about 12 pounds, requirement 600 calories):—

℞ Whole milk	22 ounces.
Water	8 ounces.
Dextri-maltose No. 3	1½ ounces.

Divide into six feedings of 5 ounces each. Feed every three hours.

Formula No. 6 (for an infant from six to nine months old, weighing about 14 pounds, requirement 680 calories):—

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[1] When loose bowels follow the use of Dextri-maltose No. 3, substitute No. 1.

TABLE No. 14.—FOOD REQUIREMENTS OF INFANTS.

Age.	Weight.	Food Capacity.	Number of Feedings.	Interval of Feeding.	Bottle Formulæ.		Caloric Requirements.
						Ounces.	
Birth to 3 weeks	7 pounds	3 ounces	7	3 hours	Whole milk[1] .... Water .... Dextri-maltose No. 3	10 11 1	310
3 weeks to 6 weeks	8 pounds	3½ ounces	7	3 hours	Whole milk .... Water .... Dextri-maltose No. 3	13 12 1	370
6 weeks to 2 months	10 pounds	4 ounces	7	3 hours	Whole milk .... Water .... Dextri-maltose No. 3	19 9 1½	450
2 months to 4 months	11 pounds	4 ounces	7	3 hours	Whole milk .... Water .... Dextri-maltose No. 3	21 7 1½	540
4 months to 6 months	12 pounds	5 ounces	6	3 hours	Whole milk .... Water .... Dextri-maltose No. 3	22 8 1½	600
6 months to 9 months	14 pounds	6 ounces	5	4 hours	Whole milk .... Water .... Dextri-maltose No. 3	26 5 1½	680
9 months to 12 months	17 pounds	8 ounces	5	4 hours	Whole milk .... Water .... Dextri-maltose No. 3	35 5 1½	770

[1] Heat milk to the boiling point.

℞ Whole milk	26	ounces.
Water	5	ounces.
Dextri-maltose No. 3	1½	ounces.

Divide into five feedings of 6 ounces each. Feed every four hours.

Formula No. 7 (for an infant from nine to twelve months old, weighing about 17 pounds, requirement 770 calories) :—

℞ Whole milk	35	ounces.
Water	5	ounces.
Dextri-maltose No. 3	1½	ounces.

Divide into five feedings of 8 ounces each. Feed every four hours.

My experience with this form of feeding has been uniformly good. When the weight is stationary, instead of adding water, it is advisable to add spinach or carrot water prepared in the following manner:

Place the spinach or carrots, with sufficient salt, in a double boiler and steam about 30 minutes or until tender (carrots require about 50 minutes). If the vegetable is young and tender it will draw sufficient moisture, if not, one or two tablespoonfuls of water must be added. After steaming, chop or mash, and squeeze out the juice by hand or with a vegetable press. If but small quantities are needed press the leaves with a spoon, the overflow into the spoon is the spinach juice. Spinach water is spinach juice diluted with eight times its volume of water. One teaspoon of spinach juice added to one ounce of water gives spinach water.

When an infant is six months old, instead of using spinach water, one level teaspoon of spinach pulp (the chopped leaves forced through a sieve) may be given with the noon feeding. Spinach contains a large amount of salts, also vitamines "A" and "B."

At six months the period of dentition should be considered. If the bowels are regular, one teaspoonful of farina or barley should be cooked one-half hour in a cup of water, with a pinch of salt and a teaspoon of sugar, and fed once daily, immediately before a P.M. bottle.

If the bowels are constipated, substitute wheatena or Robinson's groats for the farina or barley.

PERCENTAGE FEEDING.

It is now many years since the Walker-Gordon milk laboratory was established in New York. Their method of feeding infants is based on mixing the ingredients in such combination that when combined they should resemble certain chemical formulæ of breast-milk at various ages.

Theoretically the percentage feeding advocates are correct; practically we cannot successfully feed infants according to definite percentages. The simpler the formula, the less chance of contamination. Blanks are given the physician, which are filled out according to the individual requirement. The age and weight are noted. Fat, sugar, protein, and water are prescribed in percentages. We are, therefore, able to state that the food ordered contains a definite percentage of fat, sugar, caseinogen, and lactalbumin. The same is also true regarding the heating of food. We can prescribe the food sterilized, pasteurized, or raw. Many changes can be made: we can increase or decrease the fat; the same is true of sugar and protein.

The quantity of food prescribed depends on the requirements of each infant. Some infants can take 3 ounces at one feeding, while others appear satisfied after taking 2 ounces of food.

Examples.—For an infant at birth:—

Fat	2.00	Formula I
Sugar	5.00	
Protein	1.00	
Lime-water	5.00	

Milk, raw or pasteurized. Two ounces to be given every two hours.

If the infant thrives, the ingredients may be increased; also the quantity at each feeding:—

Fat	2.50	Formula II
Sugar	6.00	
Protein	1.00	
Lime-water	5.00	

Later, if conditions warrant it:—

Fat	3.00	Formula III
Sugar	6.00	
Protein	1.50	
Lime-water	5.00	

In this manner we can gradually increase the percentage of ingredients until whole milk is ordered. When abnormal conditions prevail—such as loose bowels—barley water may be substituted for the sterile water.

Clinical experience has demonstrated the fact that some children will thrive on condensed milk in spite of faulty hygiene, while others will not thrive in the best environment with the best form of feeding; again, some children will thrive on modified milk; others will not. Some cases seen by the author suffered with intense constipation, having clay-colored stools. In one instance, in which two children in one family were constantly fed on modified milk of varying proportions, the formulæ were changed at least a half-dozen times, with the usual increase of fat and sugar and lowering of the proteins, and in spite of this fact, after repeated trials, and no benefit, this feeding method was abandoned. A child, about 2 years old, was very pale, restless at night, quite peevish during the day, and decidedly backward in development. It could neither speak nor walk, although the teeth were well developed. From the time the modified milk was supplemented with vegetables, the infant improved, and from last reports is quite well developed.

Do not let us blindfold ourselves with the belief that an infant is thriving unless it shows a regularity in the increase of weight, sleeps well at night, for at least from six to nine hours continuously, and, above all, assimilates its food, as evidenced by regular, unaided movements of the bowels. Such movements should be once or twice in twenty-four hours, have a yellowish-white color, and a soft consistency. If the stool is hard or lumpy or pasty, like putty, then it is certainly abnormal, and shows improper food metabolism. The same is also true if the stool contains white, cheesy curds. In one infant, which had taken modified milk continuously for seven months, an obstinate constipation was only relieved after full doses of codliver-oil and extract of malt were given for several weeks—aided by massage, besides changing the diet.

It is, therefore, very necessary to continually watch the baby, and when abnormal conditions such as anemia prevail, it is wise to give restoratives for a long period in addition to the food. Note if the food is deficient in its nutritive elements, and, if so, change the formula so as to adapt it to the baby. *Do not give* *medicine* when the quality or quantity of food is deficient. *Remedy the food first;* then, if not satisfied, give medication.

When percentage feeding is given it is better to order the milk raw or warmed. With this we should give orange-juice and vegetable juices to add the required vitamine. Cereals may also be given to an infant about nine months old, although the cereal diluents such as barley or rice water may be given from the first month.

PELIDISI METHOD OF ESTIMATING NUTRITION OF THE BODY.

Clement Pirquet has elaborated a new system by which we can determine whether or no a child is normal, undernourished or overfed. One hundred pelidisi is the normal standard although 95 to 100 is still considered within the normal. Over 100 is regarded as overfeeding, below 95 as underfeeding.

The Pelidisi method is based on the fact that there exists a certain relation between the general bodily condition, the sitting height and the weight, which can be expressed by a mathematical formula. The word *"pelidisi"* is the abbreviation of *P*ondus (weight), *d*ecies (tenfold), *l*inear, *d*ivided by *s*itting height—and the formula is:

$$\frac{\sqrt[3]{10 \text{ weight}}}{\text{Sitting height}}$$

William A. Carter gives an elaborate description of this method of calculating food requirements, based on the sitting height and the weight.[1]

Pirquet discards the calorie, regarding the same as adapted for the engineer or physicist, but not for the physician or dietician.

He chooses the term N E M. This nem is a nutritional unit based on the food value of 1 cubic centimeter of milk.

N E M signifies *N*utritional, *E*lement, *M*ilk. Pirquet classifies the children after examination according to their *sacratama.* By abbreviating the first letter of *S*anguis, *C*rassitudo, *T*urgor and *M*uscularis he derives the word *sacratama.*

Sanguis—blood.
Crassitudo—fat.
Turgor—water.
Muscularis—muscle.

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[1] CARTER, W. A.: University of California Medical School, Journal of the Amer. Med. Assn., Nov. 12, 1921.

IX.

SUBSTITUTE FOODS.

BUTTERMILK.

BUTTERMILK and skimmed milk mixtures are indicated in low fat tolerance or fat indigestion, in loose bowels (it may also be necessary to reduce the quantity of sugar), and in malnutrition with stationary weight.

Brady suggests buttermilk mixtures which contain less carbohydrate than the usual buttermilk mixtures, and which he has found especially valuable in the feeding of institutional practice.

Mixture No. 1, which is used for young infants during the first two months, contains 11 calories in each ounce. The infant receives 4 ounces of this mixture for every pound of body weight as soon as it will take it. The infant weighing six pounds at birth is allowed to take 24 ounces in twenty-four hours, or 3½ ounces every three hours, seven feedings in twenty-four hours. The average infant at three or four days will take one ounce, at eight days 1 to 2 ounces; at fourteen days 1½ to 2 ounces; at three weeks 2 ounces; at six weeks 3 ounces; at eight weeks, 4 ounces.

Mixture No. 1:—

¾ quart of buttermilk made from skimmed milk.
½ quart barley water (thick).
1 ounce by measure, Mellin's food.
½ ounce granulated sugar.

The ingredients are mixed together in the following manner: To the barley gruel is added the cane sugar and the Mellin's food, the buttermilk is then slowly added, and the mixture strained. Note that the buttermilk is not boiled. The mixture is rather thick, and has the sour taste of buttermilk. As a rule the milk is acidified with lactic acid bacillus twelve hours before being made up, having first agitated it.

On reaching a weight of 8½ to 9 pounds infants receive the mixture No. 2, which contains 18 calories for every ounce. The babies are allowed 3 ounces of the mixture No. 2 for every pound of body weight.

Mixture No. 2:—

¾ quart of buttermilk made from whole milk.
⅓ quart barley water (thick).
1 ounce granulated sugar.

At the Infantorium we have had excellent results in weak and subnormal infants, weighing less than 6 pounds, with the following:—

Take 3 ounces skimmed milk, heat to scalding point; add lime-water, 3 drops; dextri-maltose No. 1, 1 teaspoonful. Let it cool, then add 1 ounce of buttermilk whey.

To Make Buttermilk Whey.

Boil the buttermilk—strain out curds. Use liquid portion (which is whey). To be added when it is cold. Feed 2 or 3 ounces every two and one-half hours, or every three hours.

Buttermilk in its crude (raw) state is antagonistic to other microorganisms. This is due to the presence of lactic acid bacilli. Raw cows' milk possesses bactericidal properties, but buttermilk is much more bactericidal. The latter, sterilized with the aid of steam, showed virulent typhoid bacilli nine days after being inoculated with the same. *In non-sterilized buttermilk (raw state) virulent typhoid bacilli lost their virulence after two days, and when put into the brooding oven lost their virulence after twenty-four hours.* The bacillus lacticus of Pasteur and Hueppe seems to be identical with the bacillus lactis aërogenes of Escherich, which is found in the upper part of the small intestine.

Jaworski found that pepsin is more readily secreted when lactic acid is given internally. De Mattos states that he has never met with a case of Barlow's disease among infants fed with buttermilk.

Disagreeable symptoms are frequently encountered for the first few weeks while giving buttermilk. Such are frequent vomiting and diarrhea. These are not contra-indications for feeding, and, *notwithstanding the presence of the above-named symptoms,* the feeding should be continued. If, however, the symptoms are very severe, then the administration of astringents—such as bismuth, or tannalbin—may be required for temporary relief, in 3 to 5 grain doses.

An important point is that in this form of infant-feeding the large, thick, cheesy curds so commonly met with in dyspepsia and diarrheas in feeding with cows' milk are never seen. Children thus fed seem to withstand the infectious diseases very well. A point worth noting is that when a child is more accustomed to buttermilk feeding the change to sweet milk will cause diarrhea.

When we find that the weight is not increased and we desire to change to sweet milk, the latter should be gradually added to the buttermilk instead of making a distinct change suddenly.

Quality of the Buttermilk.—This is the most important part of our subject. In securing our food we must be sure that we are dealing with honest dairymen whose sole object is to deliver what is demanded for weak infants. Stale combinations made by the use of left-over centrifugal milk or skimmed-milk or spoiled milk which cannot be used otherwise should be inquired into and rejected.

Good buttermilk can be made from either whole milk or from cream. In Holland buttermilk is made by pasteurizing cream in Timpe's apparatus and then inoculating and buttering the same with a pure culture of lactic-acid bacillus. In order that raw milk will yield buttermilk a certain percentage of acidity must be present.

The usual precautions in milking (so-called modern stable hygiene) must be observed in securing milk to be used in making buttermilk. The milk should be received in sterile vessels and rapidly cooled, and should then be kept in cool cellars or ice-coolers having a low temperature (no higher than 15° or 20° C.) for eighteen to twenty-four hours. It is necessary to stir the milk occasionally. Rapidity of souring can be assisted by adding sour milk or by inoculating with a pure culture of lactic-acid bacilli. No definite rule can be laid down as to when buttering takes place; empiric methods must decide this matter. This is due to the size of the vessel used and the influence of seasonal changes, and also the amount of churning it had received. Cows' milk which contains colostrum or which is bitter is not adapted for buttering.

Butter should form in small, pin-head-sized particles in thirty to forty-five minutes. It is regarded as a mistake to have large particles of the size of a pea or larger, and dairymen look upon such buttermilk with suspicion. Buttermilk in general contains about 0.3 to 0.4 per cent. of fat.

Escherich states that the fermentation of milk is due to the splitting up of the milk-sugar, whereby lactic acid, O_2, and CO_2 are formed in the intestine.

An important point is to overcome the lumps usually found as coarse coagula in buttermilk. De Mattos advises adding flour—either rice, wheat, or lentil—or even some proprietary infant foods, according to the requirements of the infant.

This is merely given to hold the flocculi in finer form and to prevent their coagulation into lumps. Dyspeptic children with subnormal digestive powers should receive a minimal quantity; thus, an even tablespoonful, amounting to about 10 grams, will suffice.

Addition of Sugar.—The quantity of sugar to be added must be reckoned empirically; thus, 3 tablespoonfuls, about 90 grams, are required to each liter (quart) of buttermilk. Rarely do we need more than 100 grams.

Cane-sugar or beet-sugar serves best for sweetening. Sugar cannot be found in the urine nor in the feces of infants fed on buttermilk to which sugar was added.

The results which might be expected from using cane-sugar—such as diarrhea, fermentation, sour eructations—are *totally absent* in using buttermilk feeding.

Stools.—The average buttermilk-fed infant has no more than one or two stools daily. They are *more or less solid* in consistency and *have an alkaline reaction.* It would be incorrect to state that all children fed with buttermilk *must* have yellow stools. Uffelmann, in his studies of infant-stools, states that breast-fed infants *show great variations from normal stools and still thrive.* We also know that bottle-fed infants reared on cows' milk *have no definite kind of stool* which we could call a *standard* stool. Still, the buttermilk-fed infant never has the coarse casein particles in the feces that we see very frequently in the stools of infants fed on cows' milk.

Feeding.—The writer has seen excellent results from buttermilk feeding in atrophic and marasmic children. As an article of diet during convalescence after pneumonia and typhoid fever the results were encouraging.

Quantity to be Fed.—Buttermilk as above prepared should be fed exactly as would other milk. Four ounces, increased to 5 or 6 ounces, can be fed every 3 hours, or the interval may be prolonged to 3½ or 4 hours. It will be necessary to coax the child in the beginning with this new form of feeding, owing to the difference in the taste of fresh milk and buttermilk.

LACTIC ACID MILK.

Milk soured with either a pure culture of the lactic acid bacillus, or tablets containing the Bulgarian bacillus, must not be confounded with ordinary buttermilk. By the action of the lactic acid on the casein of the whole milk, one transforms the casein into a soluble casein lactate.

How to Prepare.—Boil the milk and, when cool, skim off the skin that rises. To one quart of boiled milk add one teaspoonful of pure culture of the lactic acid bacillus, or one tablet containing such bacillus, made by the Fairchild Brothers & Foster, or by Hynson & Westcott. Set this inoculated milk in a warm place for twenty-four to forty-eight hours. The lumpy mixture must then be thoroughly shaken, and if of a thick, creamy consistency must be placed in a refrigerator to retard further souring.

SCHLOSS MILK.[1]

FORMULA A (FOR INFANTS UNDER THREE MONTHS).

6 ounces or 176 cubic centimeters of 16 per cent. cream.
4½ ounces or 140 cubic centimeters of whole milk.
23 ounces or 700 cubic centimeters of water.
3 grains or 0.2 grams potassium chloride.
1 ounce or 30 grams dextri-maltose.
½ ounce or 15 grams of flour.
1 level teaspoonful or 5 grams powdered casein.

Mix all the ingredients except the potassium chloride, and boil for fifteen minutes; cool and add the potassium chloride in solution.

FORMULA B (FOR INFANTS OVER THREE MONTHS).

6 ounces or 176 cubic centimeters of 16 per cent. cream.
4½ ounces or 140 cubic centimeters of whole milk.
23 ounces or 700 cubic centimeters water.
3 grains or 0.3 grams potassium chloride.
1½ or 2 ounces or 45 or 60 grams dextri-maltose.
1 level teaspoonful or 5 grams powdered casein.

Mix the same as preceding.

These recipes are intended to make 1 liter (quart) of the mixture. It contains the same percentage of salts and fats as human milk, but less sugar without the dextrin and maltose, and the powdered casein. If flour is used, it must be boiled with the sugar casein preparation for fifteen minutes. If no flour is used, the mixture is simply brought to the boiling point.

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[1] From ABT, "the Baby Food."

BUTTER-MEAL FOOD. (CZERNY-KLEINSCHMIDT.)

This form of feeding is adapted for infants with atrophic manifestations. The high fat content and the flour is usually quite well absorbed. Both in this country and in Europe there are enthusiastic supporters of this method of feeding, but it has failed in quite a number of cases.

The quantity given is 2 ounces, gradually increasing until 5 ounces are given at one feeding. It is given at 3- or 4-hour intervals. If the infant seems satisfied and gains weight, and the stools improve, then we gradually decrease the quantity of water and increase the quantity of milk, so that instead of using a high water content, we gradually substitute milk for the water.

[1] Flour, 1¾ teaspoons or 7 Gms.
Butter, 1¾ teaspoons or 7 Gms.
Sugar, 1¼ teaspoons or 5 Gms.
Water, 3⅓ ounces or 100 parts.

The following formula is the one used at the Babies' Hospital, New York City:

Three tablespoonfuls of butter are heated in a saucepan over a slow fire until foaming ceases—usually about 5 minutes. To this is added 2½ ounces (by measure 5 even tablespoonfuls) of wheat flour, and the whole heated with constant stirring for four or five minutes until the mass turns a light brown color. Then 20 ounces of warm water and 2 tablespoonfuls of granulated sugar are added and the whole cooked twenty minutes; if lumpy it is strained through a fine sieve; then add milk up to 35 ounces, cool, and place on ice.

For young infants under three months, give 3 ounces; between three and six months, 4 ounces every three hours. Note the stools, if hard, add more sugar. If there is no gain in weight reduce the quantity of water and increase the quantity of milk so that instead of adding 15 ounces of milk and 20 ounces of water, we reverse the amounts and give 20 ounces of milk and 15 ounces of water, and gradually replace the water with milk until a whole milk mixture is given.

If there is no gain in weight increase the quantity of sugar. Double the amount of sugar in the stock solution.

FLOUR-BALL FEEDING.

The old-fashioned flour-ball is a valuable adjunct in malnutrition. A teaspoonful of the flour added to equal quantities of milk and water is easily assimilated and will be tolerated by very feeble infants.

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[1] This formula is the one advised by Finkelstein of Berlin, and is taken from the second edition of his text-book.

In a dyspeptic infant suffering with frequent vomiting and atrophy due to the loss of food, the addition of 1 and later 2 teaspoonfuls of baked wheat-flour to each feeding was followed by an increase in weight, comfortable nights, yellowish, well-digested stools, and general improvement. After one month the gain in weight was over 1 pound. After two months of such feeding the infant was able to assimilate other starchy foods, such as arrowroot and cornstarch.

Flour-ball food is known commercially as Imperial Granum It is made as follows:—

Tie 3 or 4 pounds of wheat-flour in a muslin bag or several layers of cheesecloth, drop into boiling water, and boil for five hours. Remove from the water, and bake in an oven until hard and dry. After cooling it is broken open, the rind rejected, and grated into powder.

An infant one month old should receive:—

Milk	1 ounce.
Water	2 ounces.
Flour-ball	2 teaspoonfuls.
Dextri-maltose No. 1	1 teaspoonful.

Feed every two to three hours.

For an infant six months old:—

Milk	4 ounces.
Water	4 ounces.
Flour-ball	1 teaspoonful.
Dextri-maltose No. 3	2 teaspoonfuls.

Feed every four hours.

Rub up the grated flour-ball with a little water; gradually add the full quantity, the milk, and the dextri-maltose. Heat until the steam rises.

FLOUR INJURY.

This condition was first described by Czerny and Keller as Mehlnärschaden. When flour gruels or simple flour food are fed continuously, instead of feeding milk mixtures, acute symptoms manifest themselves due to this one sided diet.

The main point is the absence of tissue building substances, fat, protein, and salts, resulting in faulty metabolism.

This unbalanced diet causes a general breakdown in which nutritional disturbances such as rapid loss of weight, edema, hypertonia and loose stools are found. The stool is brownish in color and chiefly filled with mucus. There is belching and restlessness.

The prognosis is absolutely fatal if tetany or convulsions complicate.

Treatment.—Human milk is a lifesaver. When human milk cannot be obtained Dryco may be tried or condensed milk may be used as a temporary substitute until the digestive disturbance subsides. Buttermilk and maltose act very well in these cases.

DEXTRINIZED GRUEL.

Method of Dextrinizing.—Prepare the wheat, barley, oatmeal, or rice flour by adding a tablespoonful of the same to a pint of water, add a pinch of salt, and boil all one-half hour. This will make a gelatinous solution, hence the name of barley jelly, rice jelly, oatmeal jelly, or wheat jelly. We allow this jelly to cool, and when cool enough, then add a diastase, such as cereo; or taka-diastase, made by Parke, Davis & Co.; or the Forbes diastase. When a small quantity of this diastase is added to the jelly, it loses its thickness and *becomes very thin*. The solution is then strained through cheesecloth, and water added to make up the loss by evaporation during boiling. This jelly or gruel as it is sometimes called is to be used with the milk after the diastase is added. In certain diseases where milk is not well borne, such as dyspepsia (dyspeptic vomiting) or in summer complaint, where the giving of milk is prohibited, feeding with dextrinized gruels for several days will be found not only very useful, but very healthful. In making this dextrinized gruel, small particles will be seen floating which settle upon standing. These particles consist of the cell walls and the proteins of the cereals, and cut the curds of the milk into fine pieces when the curds begin to shrink under the combined action of rennet and acid. In using this diastase we aim at breaking up the tough curd in cows' milk by purely mechanical means.

During the summer, in the critical cases of summer complaint in which subnormal digestion exists, very good results have been seen following the administration of any and all of the malt extracts now in our market. Frequently the administration of ½ teaspoonful of malt extract to an infant immediately before feeding was not only relished by the infant on account of the pleasant taste of the malt, but certainly aided in the assimilation of the food. Rarely was more than 3 teaspoonfuls of malt ordered during twenty-four hours. Such preparations as maltine give very good results. The malt extract has a very pleasant flavor and is well borne. When malt causes belching and vomiting it should be discontinued.

GOATS' MILK.

The fat globules in goats' milk are smaller than in cows' milk. The emulsion is more even, and the fat globules better distributed than in cows' milk. Chemically there is no difference between goats' milk and cows' milk. The casein in goats' milk coagulates more quickly, according to Devarda, when rennin is added than cows' milk. There is a slight difference in the appearance of goats' milk. It has a bluish white instead of the yellowish or golden white color. Older children object to the taste and color of goats' milk. The popularity of goats' milk is due to the rarity with which the goat is infected with tuberculosis.. The popular belief is that the goat is never tuberculous, but this supposition is erroneous. Rare instances of tuberculosis in the goat have been reported.

TABLE NO. 15.

Per cent. of	Ellenburger.	Hucho.	Abderhalden.	Voelcker.			Anderegg.	Schaffer.	Steineger.
				1	2	3			
Fat	6.7	2.50 5.10	2.93	7.02	7.11	7.34	4.6	2.14 4.72	3.25
Lactose	4.5	3.76 5.46	3.92	5.28	4.68	5.99	4.3	2.07 4.77	2.80
Casein	2.8		2.56						
Albumin	0.51		0.58				1.03		
Total protein .	3.35	2.25 3.89	3.14	4.67	3.94	3.19	3.5	2.3 4.38	3.92
Ash	0.895	0.72 0.98		1.01	0.79	0.77	0.51 0.93	0.63	0.63

ALMOND MILK.

Take two ounces of sweet almonds, scald them with boiling water; after a few moments express them from the hulls; then pour the hot water away. Put the blanched almonds into a mortar and pound them thoroughly, and add either 2 ounces of milk or 2 ounces of plain water. After this is thoroughly mixed, it is to be strained through cheesecloth, and the strained liquid will be the almond-milk.

CONDENSED MILK.

Modern research has demonstrated conclusively that when condensed milk is given to an infant we must combine its use with orange-juice and other vitamine containing diets. This is essential if we wish to prevent a deficiency disease.

There are many cases of rickets which we believe are due to the improper feeding or insufficient feeding of various food elements. In one case of rickets it may be the fat, in another the protein, and in a third case it may be both fat and protein which are being given either in an insufficient quantity, or owing to subnormal conditions they are being imperfectly metabolized and as a result the structure suffers from an insufficient quantity of lime and phosphorous. In such cases there is weakness of the bones and general backwardness in bone development and delayed teething. When with deficient food elements we order cod-liver oil or phosphorized cod-liver oil, and give orange-juice daily, then we are supplying the system with sufficient vitamines. Unless we can add these elements, rickets or scurvy may result.

Condensed milk is used extensively in substitute feeding. It is sold unsweetened, as well as sweetened.

Condensed milk, otherwise known as evaporated milk is a frequent substitute for cows' milk feeding. Condensed milk will retain its sweetness and freshness for a long time. If continued for some time to the exclusion of other foods constipation will result. A point therefore is to give orange-juice, also 5 to 10 drop doses of pure codliver oil twice a day when constipation exists.

The following are average analyses:—

Eagle Brand.

Fat	9.50
Protein	8.18
Milk sugar	12.30
Cane sugar	40.50
Ash (mineral salts)	1.80
Milk solids	31.78
Total solids	72.28

PEERLESS BRAND.

Fat	8.10
Protein	7.15
Milk sugar	10.05
Ash	1.43
Milk solids	26.73

MAGNOLIA BRAND.

Fat	8.50
Protein	7.55
Milk sugar	11.38
Cane sugar	43.15
Ash	1.51
Milk solids	28.94
Total solids	72.09

On studying the above analyses one can see the high fat content of the same. The average formula used is condensed milk, 2 teaspoonfuls, and hot water 4 ounces. The strength can be increased or decreased depending on the age or requirement of the infant. For a new born infant, 1 teaspoonful to 4 ounces, of which 2 ounces may be given at one feeding. At three months of age, 2 teaspoonfuls to 4 ounces may be given every three hours, if properly assimilated.

SOY BEAN AND CONDENSED MILK.

Add a level tablespoonful of soy bean flour to 2 level tablespoonfuls of barley flour, add a pinch of salt, and mix to a paste with boiling water, adding further water to 1 quart. Boil for 20 minutes and add water to make up for the loss due to evaporation during the boiling so that total mixture is 1 quart. Condensed milk is now added, varying in quantity from ½ to 1 dram of condensed milk to each ounce of the mixture, depending upon the age and the condition of the infant. Double the quantity of soy bean and barley flours may be used for older children. Each ounce of soy bean gruel contains 10 grams of protein and 102 calories. Two ounces of soy bean gruel in a quart of water contains 0.56 per cent. protein, 0.62 per cent. fat, and 3.31 per cent. sugar (Ruhrah).

The quantity of the feedings may be varied according to the condition and needs of the infant, varying from 1 to 8 ounces per feeding.

It is indicated whenever fresh, clean milk is not obtainable. in infants with marasmus, in some intestinal disturbances associated with diarrhea.

X.

PROPRIETARY INFANT FOODS.

There are a great many infant foods in use at the present time. This is due to several reasons: First, because the laity have been educated to use them, when cows' milk or even when breast-milk, in rare instances, disagrees; second, physicians of large experience advocate the use of a great many patent foods. When disturbances in the stomach or intestines interfere with the proper digestion and assimilation of the proteins, then frequently the modification of the milk, by the addition of these foods, yields good results. In some instances where there is no appetite we frequently can stimulate an appetite by advocating the temporary use of these foods.

In the large cities, where breast-milk is unobtainable for infants, these foods are frequently given.

During the course of summer complaint, typhoid fever, or acute infectious diseases, I have frequently advised the use of diluted milk with several teaspoonfuls of a nutritious food, rich in barley malt. The objectionable features of patent foods consist in the ease with which they are procured, and the careless manner in which they are given. Thus, a large portion of the laity will follow the directions on the label of the box of patent food to the detriment of the child. Many a case of rickets or scurvy can be traced to ignorance in the use of patent foods. We know, however, that *there are some virtues in these patent foods,* and to attribute all cases of rickets or scurvy to this one cause is wrong. Investigations made by the American Pediatric Society showed that a large number of children fed on sterilized milk suffered with scurvy. A great many facts must therefore be considered before condemning or praising one or all of the foods. Every physician knows that raw milk or milk warmed to blood heat possesses antiscorbutic properties. When a given commercial food is added to raw milk, thoroughly mixed, and heated to blood heat or to a pasteurizing temperature, we still retain the virtues of the milk and increase its nutritive value with the aid of the foods selected. Roughly speaking, there are two kinds of infant foods on the market: *(a)* Infant foods to be used as adjuncts to fresh cows' milk. *(b)* Infant foods in which desiccated cows' milk is a constituent.

These foods are commonly known as dried-milk foods, although in this class of foods milk solids constitute but from one-eighth to one-fourth the substance of the foods, the balance consisting of matter derived from cereals. In some of these foods the starch of the cereals is untransformed, and they may be termed farinaceous dried-milk foods. In others the starch of the cereals has been transformed into dextrin and maltose, and they may be termed dried malted milk foods.

The group of infant foods used as adjuncts to cows' milk are either farinaceous foods, made from cereals and consisting largely of unconverted starch, or malted foods, also made from cereals, but having the starch transformed into soluble maltose and dextrin. As fresh cows' milk is, without doubt, the best generally available material for the artificial feeding of infants, the foods of the latter class, used for the modification of fresh cows' milk, are more in accord with physiological principles than are the dried-milk foods.

LIST OF INFANT FOODS.

The following list of infant foods is quite complete, although there are but four or five foods that are used in any quantity, the balance having a small demand:—

Horlick's Food (predigested, to be added to milk).

Mellin's Food (predigested, to be added to milk).

Imperial Granum (baked wheat).

Nestlé's Food (composed of cereals partially predigested and dried milk).

Mammala (dried milk food).

Dryco (dried milk food).

Klim (dried milk food).

Peptogenic Milk Powder (to modify milk).

Allenbury's Milk Food, No. 1 (predigested; prepared with water, contains dried milk).

Allenbury's Milk Food, No. 2 (predigested; prepared with water, contains dried milk).

Allenbury's Malted Food, No. 3 (partially predigested; prepared with milk).

Benger's Imported (cereal and not predigested).

Eskay's Albuminized Food.
Robinson's Groats.
Robinson's Patent Barley.
Scott's Oat Flour.

The published analyses of human milk show the great variability of its composition, especially as regards the percentage of proteins and fats. The analysis of human milk used in the following tables is by Dr. Luff, adopted as the standard by Cheadle. It agrees closely with Leed's analysis, excepting as to the fat, which is given by Luff as 2.41 per cent. and by Leeds as 4.13 per cent.; the latter amount seems too large, as it exceeds considerably the published averages of a number of observers.

NESTLÉ'S FOOD.

Nestlé's food is a farinaceous dried-milk food. According to the manufacturers, it is made of pure cows' milk, ground wheaten biscuit, barley malt, and cane-sugar. It is a form of modified milk.

No cows' milk is to be added to Nestlé's food—nothing but water.

Upon examination, maltose, dextrin, and cane-sugar will be found to be its principal ingredients, amounting to about 52 per cent. of the whole. The amount of lactose (6.57 per cent.) represents only that contained in the milk used in manufacture.

The directions for preparing Nestlé's food for the nursing bottle, for infants six months of age, are as follows:—

Place the required amount of food in the saucepan and add a sufficient amount of cold water to make a smooth, creamy mixture, then add the rest of the water, and boil for two minutes.

The total carbohydrate content of this mixture (12.57 per cent.) is considerably higher than the carbohydrate content of milk sugar (6.39 per cent.) of human milk. This, however, may be accounted for by the fact that the fat content (0.90 per cent.) is equally lower than the fat content of human milk (2.41 per cent.).

It is claimed by the manufacturers that the value of the milk used in Nestlé's food is not destroyed, as the condensing is done in vacuum, at a temperature not exceeding 130° F.

When cows' milk disagrees and gastric symptoms such as fever, vomiting, and intestinal catarrh appear, the substitution of Nestlé's food for several days will frequently relieve this condition.

Table No. 16.—Composition of Nestlé's Food When Prepared for Different Ages.

		Composition when Prepared According to Label Directions.		
		For 3d Mo.	6th Mo.	9th Mo.
Milk sugar	7.40%	0.96%	1.18%	1.30%
Maltose	15.60	2.03	2.50	2.73
Dextrin	13.51	1.76	2.16	2.36
Cane sugar	24.77	3.22	3.96	4.33
Starch	17.31	2.24	2.77	3.03
Fat	5.63	0.74	0.90	1.00
Proteins	10.92	1.42	1.75	1.91
Mineral matter	1.49	0.19	0.24	0.26
Water	3.37	87.44	84.54	83.08
	100.00	100.00	100.00	100.00

Reaction alkaline.

HORLICK'S MALTED MILK.

This is a dried milk food, said to be composed of pure, rich cows' milk combined with the extract of malted grains, and not to require the addition of milk, nor any cooking. The manufacturers claim that by their methods and apparatus the proteins are rendered very digestible and do not form large, irritating curds in the stomach.

The directions for preparing the food for an infant six months old are to dissolve 3 to 4 heaping teaspoonfuls in 4¼ to 6 ounces of water.

Table No. 17.

	Horlick's Malted Milk.	*Human Milk.*
Water	86.29	88.51
Salts	0.55	0.34
Proteins	2.31	2.35
Fat	1.24	2.41
Carbohydrates	9.61	6.39

This product is very nearly soluble in water, as its principal constituents are the soluble carbohydrates—maltose, dextrin, and milk sugar. The drying process is said to be conducted very carefully in a vacuum, and hence the solubility and digestibility of the product, it is claimed, are not lessened.

The proteins are about the same as in human milk, but the fat is about three-fifths and the carbohydrates are about five-thirds as much as in human milk.

When cows' milk causes continued constipation, the substitution of a bottle containing 8 ounces of hot water, in which 4 teaspoonfuls of malted milk are dissolved, is indicated. It acts as a corrective, as the maltose has a laxative effect.

HORLICK'S FOOD.

Horlick's food is prepared from barley, malt, and wheat flour, and is designed to be used in connection with cows' milk, as a modifier. It is free from starch or cane sugar, and is completely soluble.

When prepared with milk, as directed, it brings the carbohydrates in the form of maltose and dextrin to the proper standard, and at the same time acts upon the milk so that it is easily digested.

In some cases food prepared as above has a tendency to constipate. In such cases the substitution of malted milk for the first morning bottle will modify such constipation.

This method of modifying milk has been followed for years, by many of the medical profession, as a substitute for mother's milk or as an alternate with Horlick's malted milk.

This food is also indicated as a diet for dyspeptics, fever patients, and convalescents, as it is easily digested, palatable, and free from some of the objectionable features that pertain to the use of milk alone, as a diet.

CEREAL MILK.

Cereal milk is a malted dried-milk food. It is stated by its makers to be a complete food, cooked and ready for use with the simple addition of water, and to be made from the purest Vermont dairy milk, the finest wheat gluten flour, the best barley malt, and milk-sugar.

Cereal milk in general appearance very much resembles the other malted dried milk foods, but it contains a much greater percentage of milk-sugar.

The directions for preparing it for use are to mix 1 teaspoonful of cereal milk in a teacupful of hot water for infants under three months of age or for a very delicate child.

Preparation for a child six months old:—

To make 6 ounces Prepared Food, use 3½ rounded teaspoonfuls Cereal Milk Powder, as directed.

Composition when prepared:—

TABLE No. 18.

	Cereal Milk.	*Human Milk.*
Water	90.98	88.51
Total solids	9.02	11.49
Fats	0.38	2.41
Proteins	1.09	2.35
Inorganic salts	0.21	0.34
Carbohydrates	7.34	6.39

The reaction to litmus is neutral, or faintly acid. The food contains starch. No white of egg or cream is added, since neither is *definitely* prescribed. This fact may be taken into consideration when comparing the analysis with that of the other foods.

The total of soluble carbohydrates as above is practically the same as in human milk; the amount of proteins is less than one-half the amount in human milk, and about one-half is insoluble in water. The amount of fat is one-eleventh the amount in human milk. The small amount of fat indicates that the cereal extractives and milk-sugar make up the bulk of the solids of this food, and that a dilution of 1 part of good cows' milk with 11 parts of water would be the counterpart of the above mixture as to the amount of milk therein.

WAMPOLE'S MILK FOOD.

Wampole's milk food is a malted dried milk food. Its makers state that it is made from malted cereals, beef, and milk, and when mixed with warm water it is immediately ready for use; no other preparation necessary.

This dried milk food is very nearly soluble in water, owing to the soluble carbohydrates being so large a constituent. A little less than one-half of the proteins are insoluble in water. A small amount of beef extract has been combined with the cereal extractives and dried milk.

To prepare it for an infant 6 months to 1 year of age, the directions are to dissolve 4 to 6 teaspoonfuls of the food in 6 ounces of hot water. Composition when prepared by dissolving 6 teaspoonfuls in 6 ounces of water:—

Table No. 19.

	Wampole's Milk-food.	*Human Milk.*
Water	88.59	88.51
Salts	0.46	0.34
Proteins	1.58	2.35
Fat	0.73	2.41
Maltose, dextrin, etc.	7.65	
Milk-sugar	0.99	6.39
	Reaction alkaline.	Reaction alkaline.

Compared with human milk, it is seen that the carbohydrates are considerably in excess, and the proteins and fat are deficient, the fat especially, it being less than one-third the amount in human milk.

One part of good cows' milk diluted with about 3½ parts of water would be analogous to the dilution of milk in Wampole's milk food prepared as above.

IMPERIAL GRANUM.

Imperial Granum is composed of selected growths of wheat only, partially dextrinized with no admixture. It is generally recognized as a standardized cereal diluent for the modification of any form of milk. By its colloidal action, the casein of the milk forms finer curds than when water alone is used. The cell walls of the wheat being ruptured are free to keep the casein in a fine state of division for the action of the digestive fluids. The nutritive strength is also increased.

Imperial Granum contains no saccharine and can be used with any form of sugar, whether cane, lactic or malt.

Imperial Granum's caloric value is 117. The following directions are suited for the various ages:—

For an infant six months of age it is to be prepared by cooking 3½ teaspoonfuls of food in 21 ounces of water and 20 ounces of milk.

There is a vast difference in the chemical analysis of the various laboratories. It is better, however, to give an analysis showing the actual feeding formula after the milk has been modified with Granum. The following analysis was made by Chittenden:—

TABLE No. 20.

	Imperial Granum.	*Human Milk.*
Water	91.53	88.51
Salts	0.34	0.34
Proteins	2.15	2.35
Fat	1.54	2.41
Starch	1.22	
Maltose, dextrin, etc.	0.58	
Milk-sugar	2.71	6.39
	Reaction alkaline.	Reaction alkaline.

The following is the formula of the Laboratory of the Inland Revenue Department, Canada; Bulletin 59:—

	Per cent.
Moisture	6.04
Fat	0.72
Proteids	13.77
Soluble carbohydrates	3.94
Insoluble carbohydrates	67.46
Ash	0.49

ESKAY'S ALBUMENIZED FOOD.[1]

This food is to be prepared with cows' milk. Its makers state, in recommending their product, that it contains the more easily digested cereals, combined with egg albumin.

Eskay's albumenized food consists largely (about 88 per cent.) of carbohydrates; the soluble carbohydrates, mostly milk-sugar, are about 50 per cent., and the insoluble carbohydrates, mostly starch, are a little less than 40 per cent. On account of this proportion of starchy matter in the dry food, it may be termed farinaceous. The makers, however, claim that in the process of manufacture the starch granules are almost entirely disintegrated, and when the food is prepared with milk according to directions the percentage is said to be not over 1½ to 2 per cent. An analysis of the dry food shows that it contains about 9 per cent. of protein, but when prepared according to the six months' formula it analyzes about 2.55 per cent.

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[1] The chemical analyses of Eskay's food, Mellin's food, cereal milk, and malted milk here given were made by Professor Lafayette B. Mendel, at the Sheffield Laboratory of Physiological Chemistry, Yale University.

The fats as well as the proteins are almost entirely vegetable, with a small percentage of each derived from eggs. Excepting the egg, fat, and albumin, the preparation is produced from wheat, oats, and barley, and, while no proteolytic ferments are used in its manufacture, the insoluble carbohydrates are nevertheless partially converted into dextrin by a special process of heating, which ruptures the starch granules and converts a small amount of the starch.

The egg albumen is said to be first combined with sugar of milk in such a thorough manner that the particles are finely subdivided, and no firm, hard coagulum can therefore take place in the stomach. The particles retain their identity, and do not coalesce; so that in the finished preparation the egg albumen is suspended throughout the whole mixture in very fine particles, which are easily digested, because the gastric juice acts by contact, and, the smaller the particles, the greater the effect of the gastric juice. No claims are made by the manufacturers for its solubility, but for its ease of digestion and its nutritive value.

The directions for preparing it for an infant six months of age are to take:—

Eskay's food	5 tablespoonfuls.
Hot water	1 pint.
Rich cows' milk	2 pints.

As directed.

Composition when prepared as above:—

TABLE NO. 21.

	Eskay's Food.	*Human Milk.*
Water	84.46	88.51
Total solids	15.54	11.49
Fats	3.07	2.41
Proteins	2.78	2.35
Inorganic salts	0.58	0.34
Carbohydrates	9.11	6.39

The reaction to litmus is amphoteric.

The food contains a noticeable quantity of starch, which is in the form of a thin paste, in which all the grains are ruptured by the process of preparation. The boiling was carried on for fifteen minutes in the sample analyzed.

Rich milk (4.85 per cent. of fat) was used as specifically directed.

MELLIN'S FOOD.

Mellin's food is a malted cereal. This food is stated by its makers to be a soluble dry extract from wheat and malt, for the modification of fresh cows' milk.

ANALYSIS.

Fat		0.16
Proteins		10.35
Maltose	58.88	
Dextrins	20.69	
Soluble carbohydrates	——	79.57
Salts		4.30
Water		5.62
		100.00

The salts, 4.30 parts, consist of:—

Bicarbonate potassium	2.536
Phosphate potassium	.897
Phosphate calcium	.037
Phosphate magnesium	.213
Phosphate iron	.016
Chloride sodium	.097
Sulphate sodium	.131
Sulphate potassium	.383
	4.310

The carbohydrates therein are in the form of dextrin and maltose, and constitute about 80 per cent. of the food; the proteins amount to about 10 per cent. and are derived from the cereals. Mellin's food is almost completely soluble in water. It is especially noticeable that this food does not contain any starch.

WHOLE MILK FORMULA FOR NORMAL INFANT, SIX MONTHS OLD OR OVER.

Mellin's food	3½ level tablespoonfuls.
Milk	12 ounces.
Water	4 ounces.

ANALYSIS OF ABOVE MIXTURE:

Fat			2.67
Proteins	milk	2.52	
	cereal	.49	3.01
Carbohydrates (no starch)			7.12
Salts			.71
Water			86.49
			100.00

Calories per fluidounce 21

The reaction to litmus was amphoteric. The food gave no reaction for starch. Milk having 4.25 per cent. of fat was used in this preparation.

In total solids this food differs but slightly from human milk, and in the various constituents its similitude to human milk is remarkably close. Of the carbohydrates the maltose and dextrin are a little less in amount than the milk sugar, and the total carbohydrates (7.12 per cent.) are greater than the amount in human milk.

One level tablespoonful of Mellin's food added to a 16-ounce mixture increases the percentage of

Proteins	0.14 per cent.
Carbohydrates	1.10 per cent.
Salts	0.06 per cent.

DRY MILK (Dryco).

This dry powder contains 4 calories to the teaspoonful and is soluble in hot water. It is readily taken by infants. Dry milk is by no means a new preparation. Such foods as Nestlé's food mammala, malted milk, klim and Allenbury's food are dried milk to which sugar, and in some instances, wheat flour or malt has been added. Dryco does not contain sugar and where there is a low sugar tolerance or low starch tolerance, then dry milk is an excellent food. It is readily taken by the older child and equally well taken by the premature infant without causing gastrointestinal derangements.

Dose.—In the premature infant we can begin with 1 or 2 drams to 1 ounce of hot water every two hours, gradually increasing the quantity of dry milk by noting the weight daily, and the general condition of the infant. I have frequently increased the quantity of dry milk from 1 to 4 drams to 2 ounces of hot water three days after beginning the feeding. If there is no gain in weight two days after using the dry milk then we can add ¼ dram cane sugar to each feeding. In some cases where carbohydrate intolerance exists infants will regurgitate or vomit when sugar is added. It is obvious that in such cases dry milk without sugar must be given. Excellent results have been obtained in a large number of cases where dextri-maltose (Mead's) ½ to 1 dram was added to the dry milk.

In the process of making Dryco the vitamines are not destroyed. This has been chemically proven by Hart, Steenbock and Ellis.[1]

I frequently use spinach, carrot or parsnip water instead of plain water as a diluent, with excellent results. These vegetable waters contain the earthy salts and are readily taken by the youngest infants. Orange-juice may be given to very young infants in ½-dram doses, gradually increased to several drams per day.

In a series of premature infants and cases of malnutrition treated at the Infantorium, in which even the weakest milk mixtures such as whey and buttermilk whey were not tolerated, Dryco was retained and well assimilated.

In gastric irritability with vomiting caused by fat intolerance Dryco is an excellent substitute feeding.

In using Dryco we have a very soluble preparation, easily digested. The stool is soft and of a greenish-yellow color. Gastric disturbances have not been noted, and colic and flatulence rarely found with this form of feeding.

Indications.—When pyloric irritation caused by pyloric spasm exists then dry milk should be ordered. One teaspoonful, levelled, to each three ounces hot water, may be given every two hours to an infant 2 months old. If vomiting is noted reduce the quantity of dry milk to ½ teaspoonful.

Food Requirements.—An emaciated, weak infant requires 50 calories per pound body-weight. To obtain 50 calories we must give 3 tablespoons levelled with a knife. Every tablespoon of dry milk contains 16 calories. A seven pound infant therefore requires 3 level tablespoonfuls seven times in the twenty-four hours. Fat or well nourished infants require but 40 calories to the pound. An infant therefore in good health will gain on a feeding of 2½ tablespoonfuls dry milk for each pound of body-weight per day, or seven times in twenty-four hours.

Start with small quantities or one or two teaspoonfuls, increase to three or four teaspoonfuls, and gradually increase until the caloric requirement is reached.

KLIM.

There are two kinds of Klim on the market. *(a)* Powdered whole milk and *(b)* powdered skimmed milk. In the process of transferring liquid milk to powdered milk the water is evaporated and the milk in its original form is reduced to a powder containing fat, casein, albumen, sugar and salts. By adding 1 ounce of powder to 7 ounces of water by weight we can restore this powder to its former state of liquid milk.

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[1] Hart, Steenbock and Ellis: Journal of Biological Chemistry, April, 1921.

This form of feeding is well adapted for the delicate infantile stomach. Its use therefore is indicated in the new-born, in the premature, and in the infant with gastric irritability. It is a useful adjunct to Granum mixtures. Dextri-maltose and other carbohydrates may be added if the weight does not increase. My plan has been, during Klim feeding, to order orange-juice or tomato juice as an adjuvant.

Klim made from skimmed milk serves best in infants who are emaciated or who vomit easily, and where fat intolerance exists. After a few weeks we can generally change to whole milk Klim. This form of food is readily taken by infants, and is easily digested.

Klim has been used as a substitute food, at the Infantorium, in a series of atrophic cases and in premature infants with good results. Three to 5 drams of Klim are added to each ounce of water. When 2-ounce feedings were given we began with 6 drams of Klim, with ½ to 1 dram of maltose No. 1, added to each feeding. In some cases ¼ dram of granulated sugar was used instead of the maltose.

MAMMALA.

Mammala is claimed to be a milk from which a part of the cream has been removed, an additional proportion of milk sugar added, and then dried by the Hatmaker process, at a temperature of 280° F.

It is a white powder to be dissolved in hot water with no addition of sugar or lime water. It is a simple formula and one adapted for substitute feeding.

Mammala is given in the same quantity as Dryco, and the same vitamine containing foods as orange-juice and carrot water should be added as outlined in the article on dry milk.

The absence of a live factor such as an enzyme would contraindicate the use of such food for a prolonged period. We must always bear in mind the possibility of the development of scurvy where an absence of fresh milk exists.

PEPTOGENIC MILK POWDER.

This product is stated by its makers to be an article containing milk sugar and a digestive ferment capable of acting on casein, offered for the preparation of an artificial infant food. McGill states: "It is not, in the strict sense, a food. Its professed object is so to change the composition of cows' milk as to render this comparable to human milk. This it seeks to do by introducing milk sugar and small quantities of albuminoids." According to McGill's analysis, it is composed almost entirely of milk sugar (96.6 per cent.).

The following analysis is by Leeds, and is taken from a circular of the makers.

Composition of "humanized milk" prepared as directed, using 4 measures of peptogenic milk powder with ½ pint of milk, ½ pint of water, and 4 tablespoonfuls of cream:—

TABLE No. 22.

	Humanized Milk.	*Human Milk.*
Water	86.20	88.51
Ash	0.30	0.34
Proteins	2.00	2.35
Fat	4.50	2.41
Milk-sugar	7.00	6.39
	Reaction alkaline.	Reaction alkaline.

Chittenden's analysis of this "humanized milk" is almost identical with the above.

The proteins of the cows' milk undergo a change in the peptonizing process, being converted chiefly into peptones, and in this form they cannot be said to resemble the proteins of woman's milk, which have not been acted upon by a proteolytic ferment.

The prolonged use of peptogenic powder may do harm. It should be used as a corrective for several weeks and gradually be replaced by a food having a higher protein content.

Heavy cream	1 ounce.
Milk	6½ ounces.
Water	16 ounces.
Peptogenic milk powder	1½ measures.

Heat to 95° or 100° F. for eight minutes, then bring quickly to boiling point, or pasteurize by heating to 160° F. in open saucepan.

TABLE NO. 23.—SUMMARY GIVING COMPARISON OF THE FOODS ANALYZED BY MENDEL.

	Cereal Milk.	Malted Milk.	Mellin's Milk.	Eskay's Milk.	Human Milk.
Water	90.98	90.74	85.37	84.86	88.51
Total solids	9.02	9.26	14.63	15.54	11.49
Fats	0.38	0.63	3.16	3.07	0.34
Proteins	1.09	1.65	3.03	2.78	2.35
Inorganic salts	0.21	0.36	0.76	0.58	2.41
Carbohydrates	7.34	6.62	7.74	9.11	6.39
Reaction to litmus	neutral	alkaline	amphoteric	amphoteric	

(The figures indicate percentages by weight.)

The figures quoted for human milk are well-known averages; it would be more accurate to give figures indicating the healthy variations.

TABLE NO. 24.—CHEMICAL ANALYSES BY ERNST J. LEDERLE AND J. A. DEGHUE.

An interesting comparison as to the alcohol content can be made by studying the analyses of the six nutritive tonics submitted for examination; they are:—

Nutritive Liquid Peptone (Parke, Davis & Co.)	23.49 per cent. alcohol by volume
Liquid Peptonoids (Arlington Chemical Co.)	17.59 per cent. alcohol by volume
Mulford's Pre-Digested Beef. (H. K. Mulford & Co.)	19.39 per cent. alcohol by volume
Tonic Beef (Sharp & Dohme)	17.04 per cent. alcohol by volume
Trophonine (Reed & Carnrick)	18.98 per cent. alcohol by volume
Panopepton (Fairchild Bros. & Foster)	20.05 per cent. alcohol by volume

XI.

ADDITIONAL NUTRIENTS AND STIMULANTS.

MEIGS'S FOOD.

MEIGS'S food consists of milk, cream, sugar, gelatine, and arrowroot, and is prepared as follows: Of Russian gelatine or isinglass, 20 grains, or a piece about two inches square, is soaked for a few minutes in cold water, and then boiled in half a pint of water for fifteen minutes, or until completely dissolved. One teaspoonful of arrowroot is mixed to a paste with cold water, and then added to water to make half a pint. This is now added to the gelatine solution, as is also, with constant stirring, the desired quantity of milk; just before removing from the fire the cream is added. The amount of milk and cream used should vary with the age of the infant. For an infant under one month, 4 ounces of milk and 1½ ounces of cream are to be used; for those older the milk is gradually increased to 16 ounces and the cream to 2 ounces.[1]

ZOOLAK.

The subjoined analysis of Zoolak was made by Edgar E. Wright, of Brooklyn, N. Y.

In every 100 parts of Zoolak there are:—

Water	87.69
Protein substances	3.98
Fat	4.91
Milk sugar	2.03
Alcohol	0.07
Ash or mineral salts	0.78
Lactic acid	0.50
Carbon dioxide	0.04

This analysis shows that in the production of Zoolak but little change is wrought in the percentage composition of the original cows' milk, *save what would naturally be produced* by the fermenting and peptonizing actions of the kefir ferment.

These fermentative changes—primary and secondary—consist in:—

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[1] MEIGS AND PEPPER: "Diseases of Children."

1. The transmutation of a portion of the natural milk sugar into alcohol, lactic acid, and carbon dioxide.

2. The transmutation of a certain percentage of the protein substances into proteoses, and finally, perhaps, into true diffusible peptones. This latter action, however, does not change the percentage presence of the protein bodies, as related to the total quantity of milk, but simply changes their chemical form.

Owing to the instability of the Bulgarian bacillus in dry or tablet form, it is advisable to procure a fresh culture in liquid form, which can be used as an antifermentative in gastrointestinal colic, and especially in constipation.

THE NUTRITIVE VALUE OF EGGS.

It is commonly asserted that an egg contains as much food value as a half-pound of meat. This is not true. While there is an approximate equivalent between the albuminoids contained in both, the egg contains no carbohydrates. Very young infants do not digest eggs, and frequently gastric disturbances result from their use. This does not necessarily imply that the white of egg should never be used as an adjunct to other forms of feeding, or as a temporary food when milk disagrees or when diarrheal conditions, such as fermentative and catarrhal intestinal diseases, prohibit the use of milk.

Digestibility of Eggs.—There is a popular belief that egg white, raw or soft boiled, is easily digested. This is not founded on experience. It has been experimentally proven that the hard cooked egg white is more digestible than the soft boiled or raw white.

LECITHIN.

Lecithin is a crystallizable fat of a peculiar nature containing nitrogen and phosphorus. It is unstable. When chemically treated by neurin and glycerin, phosphoric acid can be isolated. Lecithin has also been found in the yolk of egg, in the egg of fish, etc. Hoppe-Seyler isolated this substance in 1870 from its constant association with phosphorized albumins, nucleo-albumin, and nucleo-protein. Lecithin is also found in the brain matter.

Free lecithin was used clinically and physiologically by Danilewski in 1895. According to this physiologist, animals fed with lecithin grew more rapidly than those not fed on this substance. My experience with lecithin has been limited to rachitis, tuberculosis, and cases in which atrophy due to malnutrition is found, such as result from pertussis.

A preparation of lecithin containing one grain of pure lecithin to the dram is made by Fairchild Bros. & Foster, of New York City. A teaspoonful of this solution may be given three times a day before meals.

Lecithin of the Egg.—According to Coloumbe, lecithin exists in all the tissues, especially in those endowed with great vitality. From a therapeutic point of view it is not toxic, and it is assimilated as a whole in ordinary doses. Its action consists in increasing the number of red corpuscles; in increasing, in certain cases at least, hemoglobin; in increasing urea and diminishing uric acid, and in stimulating the appetite. Its employment is indicated in anemia, in all troubles of nutrition, in wasting diseases, and in neurasthenia. It may be administered hypodermically or by the mouth.

STEAK JUICE OR MEAT JUICE.

The juice of broiled steak possesses anti-rachitic properties. When dentition is delayed or when the bony structure is weak, as in rickets, steak juice should be freely given. It is best prepared fresh each day. For this purpose a meat press or lemon-squeezer is convenient. From a pound of lean steak, slightly broiled, about three ounces of juice can be obtained. This may be slightly salted and given cold or warm, but not sufficiently heated to coagulate the albumen.

If the taste is objectionable, it may be given in milk; two to three teaspoonfuls added to eight ounces of milk will not be noticed. The milk should not be warmed above 100° F. before the addition of the steak juice.

For older children we can add the steak juice to mashed potato, spinach, or rice. Bread or toast saturated with steak juice is liked by many children.

When fresh steak juice cannot be obtained, then Valentine's meat juice can be tried. For the treatment of scurvy fresh meat juice must be used.

CHOCOLATE AND COCOA.

The addition of cocoa to milk is a valuable adjuvant. The flavor of cocoa will frequently render the milk more palatable.

Cocoa is made from bitter chocolate by expressing part of the cocoa butter and grinding the partially defatted material to a fine powder. The amount of cocoa butter remaining varies from 20 to 30 per cent. Cocoa for drinking purposes has about 25 per cent. cocoa butter. Cocoa of this composition has a calorific value of about 1769 calories per pound, and contains approximately 19 per cent. protein. A teaspoonful of cocoa powder, required to make a cup of the beverage, would therefore have a fuel value of about 20 calories. Added to the caloric value of a cup of 4 per cent. milk, which is 120 calories, we have the caloric value of a cup of cocoa, which is 140 calories.

Analysis of Cocoa Powder.

Fat	24.12 per cent.
Moisture	3.57 per cent.
Crude fiber	4.48 per cent.
Total ash	5.17 per cent.
Water-soluble ash	2.06 per cent.
Water-insoluble ash	3.11 per cent.
Alkalinity (soluble of ash)	1.85 c.c. N/10 acid per gram sample.
(insoluble)	4.51 c.c. N/10 acid per gram sample.

Bitter chocolate is the product obtained by grinding cocoa nibs (roasted cocoa beans). Such bitter chocolate contains about 52 per cent. of cocoa butter.

Sweet chocolate is the same as bitter chocolate with the addition of about 50 per cent. of sugar, depending on the formula. Its caloric value is about 2620 calories per pound.

ICE-CREAM AND WATER-ICES.

Ice-cream and water-ices are agreeable to a feverish child. When milk and cream are refused they will be greedily taken. These preparations will alleviate the pain on swallowing in diphtheria. They contain considerable nourishment, but must be given in moderation. Nausea and vomiting may frequently be controlled by them.

COFFEE.

Contraindications.—When giving coffee to children we must bear in mind that:—

First.—Coffee is in no sense a food, because it can neither build up the tissues nor provide them with potential energy.

Second.—Coffee perhaps acts the part of a lubricant to the machinery of the body, and exerts its stimulating influence by toning up and diminishing nervous fatigue in adults, and is not called for in children.

Third.—Coffee produces a disturbance of digestion due to a direct *interference* with the *chemical* part of the process, but in part also indirectly brought about by the nervous system; it also produces a dyspepsia which is of the *atonic* type, and a slow digestion, accompanied by flatulence, with a disturbance of the heart's action, so that it is decidedly contraindicated from a feeding standpoint.

Coffee is a cardiac stimulant, quickening the heart's action in small doses, and depressing it in large quantities.

It certainly disturbs the cardiac rhythm when taken in excessive doses by children. Such symptoms as muscular tremor, nervous anxiety, and dread of impending danger, as well as palpitation, cardiac intermissions, and an uncomfortable feeling referred to the cardiac region can be traced to coffee, according to Yeo; it is a diuretic, and increases the excretion of *urea;* it produces insomnia, nervousness, and fear; also, choreiform movements.

Caffeine has been known to produce paralysis in the lower animals, and might produce a similar effect if taken in large quantities by children. It retards digestion; hence it is contraindicated in children.

Indications.—As a cardiac stimulant, or whenever caffeine is indicated, hot coffee should be given in small doses, one or several teaspoonfuls, repeated every fifteen minutes, until its physiological effect is manifested. This can only be noted by studying the pulse. Great care should be exercised in administering large quantities of coffee to children, or very strong coffee, as in either instance it will produce a marked cardiac depression, and also a disturbance of the cardiac rhythm.

In the convalescence of typhoid fever or pneumonia in children, there is no better stimulant than coffee administered in small doses to which large quantities of milk or cream are added. This is an especially valuable drug in the great cardiac depression so frequently noted in the convalescence of diphtheria. (See chapter on Diphtheria.) The coffee usually used consists of the following strength:—

Coffee	2 ounces.
Water	1 pint.

When an infusion of the above strength is made, Hutchison found that each teacup of coffee contained:—

Caffeine	1.7 grains; and also
Tannic acid	3.24 grains

The latter in the form of gallo-tannic acid; so that judging from this analysis, coffee should be made much weaker (one ounce to a pint of water), and should be administered in teaspoonful doses.

ALCOHOL.

Alcohol in the form of wine or beer or whiskey, in any and every form, is not only detrimental to the infantile organism, but will leave permanent injury if its use is prolonged. There is a decided difference between the continual use of alcohol as a food and its use when indicated as a medicine. Physicians know that whiskey or wine, given to stimulate the weakened heart in the course of a septic pneumonia or diphtheria, is not only necessary, but frequently the only means of prolonging life. If a child has been given alcoholic drinks daily as an adjuvant to other articles of food, when it is required to stimulate the heart we must resort to enormous doses to procure an effect.

Alcohol should be regarded as a poison; therefore, is an irritant to the kidneys. The growing child does not assimilate alcohol. It interferes with the metabolism of fat and protein, and its use therefore should be limited to stimulating the heart when weakness exists during a septic process.

In a large children's clinic with which I have been associated it was very interesting to study the amount of alcohol given to young children, and I was surprised to find that more than 50 per cent. of all children from six months old and upward regularly received their sip of beer or drop of whiskey "to strengthen their hearts." The author has frequently attended alcoholic dyspepsia due to prolonged use of beer and wine. This is most common among the tenement population, where the baby forms part of the family at the table, and necessarily partakes of almost everything eatable and drinkable along with its parents.

In the routine examination it is the duty of every physician to inquire into the habit of giving alcohol to children.

TEA.

In discussing the use of coffee, I have already mentioned the deleterious effect of coffee on the growing infant or child. What has been said there regarding coffee applies equally to the use of tea. The nervous system when overstimulated in an infant is far more sensitive than that of the adult. The author has frequently noted that children suffered with sleeplessness and were very irritable, simply through the prolonged use of such stimulants as tea and coffee. A noteworthy point is that the appetite disappears when tea and coffee are given, and reappears when their use is interdicted.

It must not be supposed that tea is a poison to children, and there are times when physicians will find it necessary to use small quantities of tea to stimulate the body.

Theine, the active principle of tea, is an astringent and has properties similar to tannic acid. It is indicated in colitis, and is readily taken by children.

PART II.

The Development and Hygiene of the Infant. Diagnostic Suggestions.

I.

INFANCY AND CHILDHOOD.

THE NEWLY BORN INFANT.

THERE are several anatomical and physiological changes which occur when an infant passes from a passive intrauterine to an active extrauterine existence. The lungs have had no intrauterine function. They become active as soon as the infant makes its first inspiration. The stomach and bowels become active the moment the first mouthful of food is swallowed. The blood-vessels of the umbilical cord, which have nourished the child, rapidly atrophy as soon as breathing is established. The following are the most important changes that take place early in the infant's life:—

1. The meconium is expelled.
2. The umbilical cord separates.
3. The navel becomes cicatrized.
4. The epidermis cracks and falls off.
5. The hair is renewed.
6. The umbilical vessels are obliterated, and the foramen ovale is closed.

Infancy.—The term infancy is best applied to that period from birth until all of the milk-teeth have appeared, which is about the end of the second year of life.

There are certain anatomical peculiarities which are important to mention, namely:—

1. The thymus gland.
2. The large size of the liver.
3. The existence of an anterior and posterior fontanel.

Childhood.—The term childhood is applied to that period from the end of the second year to about the sixteenth year.

Childhood ends when puberty begins. Then follows the stage of *adolescence*.

II.

THE DEVELOPMENT OF THE VARIOUS SENSES.

MENTAL FACULTIES.[1]

Senses.—The following is the order in which the various senses appear developed: Taste, sight, touch.

The *taste of milk*, the *sense of feeling*, the *sight of the mother*, the *presence of the father or the nurse*, are distinctly apparent about this same time. An infant will notice the absence of its mother about the fourth month, and also notice the difference in the sound of the voice.

Reflex Actions.—Yawning may begin at the end of the first week of life.

Sighing commences in the twenty-eighth week.

Urine is passed consciously by the infant between the thirty-sixth and fortieth weeks. From this time on it is advisable to try to train the child to be clean and use a chair.

Suckling or Nursing.—This seems to be congenitally acquired. Between the eighth and tenth months an infant should know enough to properly guide a nursing bottle to its mouth. It should also know enough to properly inspect its various toys at this age.

Supporting the Head.—The infant should support its head for a few moments in the fourteenth week, and should be able to properly support the head about the sixteenth week.

Sitting usually commences between the seventeenth and twenty-sixth weeks. The child should be able to properly support the body between the thirty-sixth and fortieth weeks. About the forty-second week the child should be strong enough to support its back thoroughly. Commencing with the forty-fifth week the sitting position should be permanently established.

When children can sit up and play they should be placed on the floor, having a clean rug under them. Active movements can be suggested by rolling a small ball or giving the child some toy to play with. The tendency to put everything into the mouth must be considered. Hence, large toys, such as hollow rubber balls, are best. Playing with beans, peas, and bullets has frequently given many a physician an opportunity to try his skill in removing them from such places as the middle ear, the nostril, and most frequently the stomach.

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[1] The brain, fontanel, and reflexes of the body are described in detail in Part IX, Vol. ii, Diseases of the Brain and Nervous System.

Stamping with the feet in the forty-fourth week.

The first attempts at walking appear about the forty-first week. *Walking* unaided is rare before the end of the first year. Two-fifths of all children learn to walk between the fourteenth and fifteenth months. Thus children must not be expected to walk properly until they are one and a half years old.

Children having suffered with disordered stomach and bowels, whether from faulty feeding or inherited disease (syphilis) or other organic disorders, may, if urged to walk in a weakened condition, get deformities, such as bow-legs.

Children will not *jump, climb, throw things, or turn* unaided before they are between two and three years old.

Infants do not learn to *imitate* before the twenty-eighth week.

Laughing begins as early as the eighth, sometimes not before the seventeenth, week. An infant will laugh heartily with tears in its eyes about the forty-fourth week. The mouth will show an expression the moment the infant's attention is attracted, between the third and seventh week.

Kissing with the lips usually at the fifteenth month.

Tears, when crying, can be noticed after the tenth week.

Memory.—The memory of an infant can be noticed sometimes before the thirtieth week. The *memory* seems to be very acute in the fourth year of life. It is surprising to see how much children will remember, and how acute their mental faculties will be, in the fourth year of life.

Voice Sounds.—Children will study the movements of the mouth of adults, and will learn to note the difference in sound. They will remember the meaning of words, especially when brought into use in connection with certain objects or places. Words will be uttered in accordance with no distinct rule. This is a peculiar individuality which is difficult to record. One child will speak ten words at the age of ten months, and be in a normal condition. Another child will speak but six words at the age of sixteen months and yet be physically and mentally in a normal condition. This shows the marked difference in various children in apparently good health.

VERY LATE SPEAKING, SLOW DEVELOPMENT, GOOD PROGNOSIS.[1]

The center of speech may be inactive, and show no signs of development until the end of the second year. If the child is otherwise healthy no alarm need be felt at this state of affairs. If, however, the child is backward in its physical development as well as its mental development, then treatment must be sought to remedy this condition. If a child has rickets, its soft bones and flabby muscles require restorative treatment.

SUDDEN LOSS OF SPEECH DUE TO PARALYSIS.

If an infant shows proper development, commences to speak, and for no apparent reason stops speaking, the cause of the condition should be carefully investigated. For example: A child suffering from a severe infectious disease, like diphtheria, may, during convalescence, develop paralysis, which might cause the sudden cessation of speech. Its treatment with deep muscular injections of strychnine, and faradization, will benefit the condition. The neglect of treatment at such a time may result in permanent injury to the child.

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[1] See article on Alalia Idiopathica, Part IX, Vol. ii, p. 967

III.

THE DEVELOPMENT OF THE BODY.

GROWTH AND HEIGHT.

The average height of the newly born male is from 19½ to 20 inches (about 50 centimeters). In the female from 19¼ to 19¾ inches (about 48.5 centimeters). Holt's average is one inch more in both male and female children at birth. A child grows most rapidly during its first year.

Table No. 25.

Increase during	
First year	5 to 6½ inches.
Second year	2½ to 3½ inches.
Third year	2⅓ to 2⅔ inches.
Fourth year	about 2 inches.
Fifth to sixteenth year	annual increase from 1½ to 2 inches.
Sixteenth to seventeenth year.	1½ inches.
Seventeenth to twentieth year.	1 inch yearly.

Diseases of the bones, rickets, and scurvy retard growth. A child should begin to walk at the end of twelve months. If a child, when commencing to walk, places its toes chiefly on the floor, and has a limping gait, more especially if symptoms of pain be noticed in one knee, and tenderness be caused by handling the limb, hip-joint disease may be suspected.

WEIGHT AND DEVELOPMENT.

When a child develops normally, it gains in weight. Breast-fed infants, as a rule, gain more than bottle-fed infants. The progress of an infant can be watched by a comparison with its weight. The moment a child's weight is stationary, the reason for the same should be ascertained. If the baby is breast-fed the milk of the nursing mother should be sent to a chemist for examination. (The details have already been described in the article on Breast-milk.)

Disturbances of the mother interfering with proper lactation are at once evident in her milk. Such disturbances as: (*a*) menstruation; (*b*) general anemia; (*c*) tuberculosis, and (*d*) pregnancy will frequently alter the percentage of the ingredients of milk so that a child will not receive sufficient nutrition.

The first evidence of such malnutrition will be seen on the scales. The child will not gain in weight, and frequently it will lose weight.

How Much Should an Infant Weigh?—The average weight at birth is 7 pounds. Some children weigh considerably more and some less. A child should double its weight at the end of six months, and treble its weight at the end of the first year. It must not be supposed that because a child weighs less than this amount it is not healthy. All factors should be taken into consideration and a child should be carefully examined to determine whether or not it is normal. Very many babies are up to the normal in weight, and still show marked rachitis. The very fat and flabby baby—usually supposed to be extremely healthy by the laity—is the one in whom the physicians most frequently meet constitutional disorders. Thus, too much stress should not be put on the scales, for we know that they have their limitations. In the beginning, or during the first and second months, a normal infant gains about 6 to 8 ounces a week. During the third month a child gains from 4 to 6 ounces per week, and after the third month from 3 to 4 ounces per week.

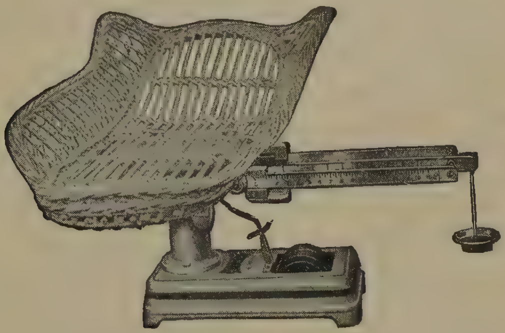

Fig. 38.—Infant scale.

Weighing Immediately After Nursing to Determine the Quantity of Milk an Infant has Taken.—When scanty milk supply is suspected in either the nursing mother or in a wet-nurse, then we can, in some instances, resort to weighing immediately after the baby has nursed. It is understood that the child must be weighed both immediately before nursing and then immediately after nursing. The difference in weight is the amount of milk swallowed.

While this may serve in some cases, the author has not found it very practical, and cannot recommend it, excepting in rare instances.

It is well known that an infant whose stomach is filled requires rest after nursing, and the less it is handled the less is the chance for expelling its food. Thus, my advice is not to handle or fumble with a child after nursing, but rather to aid Nature in resting an infant than to provoke vomiting by unnecessary handling.

TABLE NO. 26.—SHOWING THE GAIN OF A HEALTHY INFANT FED AT THE BREAST.

Normal weight at birth, 7 pounds.	Gain at the end of the first week, none.
Weight when 2 weeks old, 7 pounds, 6 ounces.	Gain at the end of 2 weeks, 6 ounces.
Weight when 3 weeks old, 7 pounds, 14 ounces.	Gain at the end of 3 weeks, 14 ounces.
Weight when 4 weeks old, 8 pounds, 6 ounces.	Gain at the end of 4 weeks, 22 ounces.

No method of feeding has yet been devised that will replace human milk in the weak or premature infant. Temporary substitutes such as the dried milks—Dryco, Klim and Nestlé's food are useful for a short time only. They are especially indicated when pyloric irritation exists, and vomiting takes place.

The weight must be taken daily, and if there is no gain in an infant under five pounds, then human milk should be procured and given at least three times in twenty-four hours.

Condensed milk or evaporated milk is serviceable in many cases but it should be discarded if metabolism shows poor stools and no gain in weight.

Many of these cases do exceptionally well on buttermilk whey. This is described in the chapter on Buttermilk Feeding. Beginning with 1 ounce we can feed 2 to 3 ounces every two hours. To this buttermilk whey, maltose in ½ teaspoonful doses can be added to each feeding. If the feeding is retained then ½ ounce of whole milk can be added to each 2 ounces of buttermilk whey.

The following cases will serve to illustrate the weight of infants with various methods of feeding—(*a*) breast-feeding, (*b*) home modification, (*c*) laboratory feeding:—

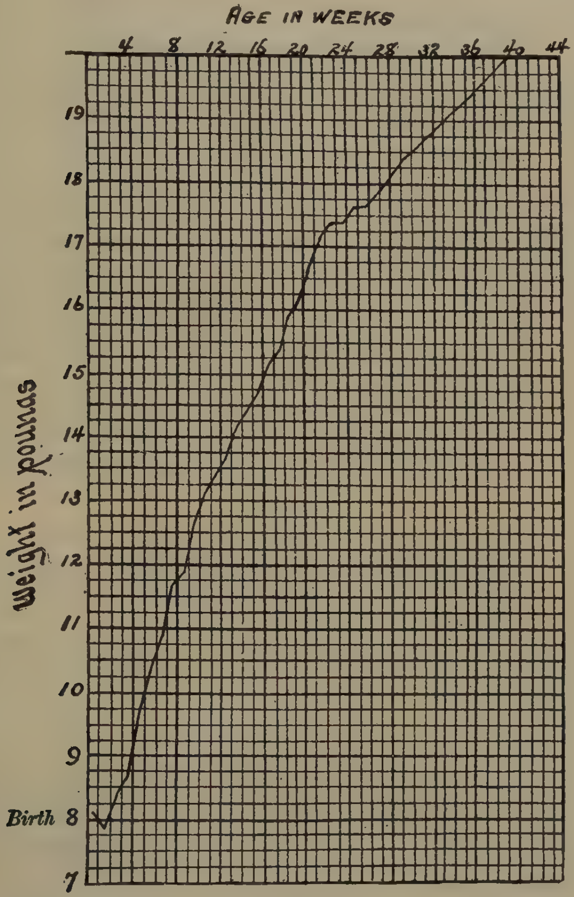

Fig. 39.

Baby Robert M. F. Normal at birth. Was wet-nursed. Gain, first month, 1¼ pounds; second month, 1¹¹⁄₁₆ pounds; third month, 1⅝ pounds; fourth month, 1⅛ pounds. Stools were normal. Had gastric disturbances and symptoms of colic while the wet-nurse menstruated. When the child was about 7 months old the chemical analysis of the breast-milk showed a deficiency of fat and quite a high percentage of proteins. The milk supply gradually gave out and it was necessary to wean the child.

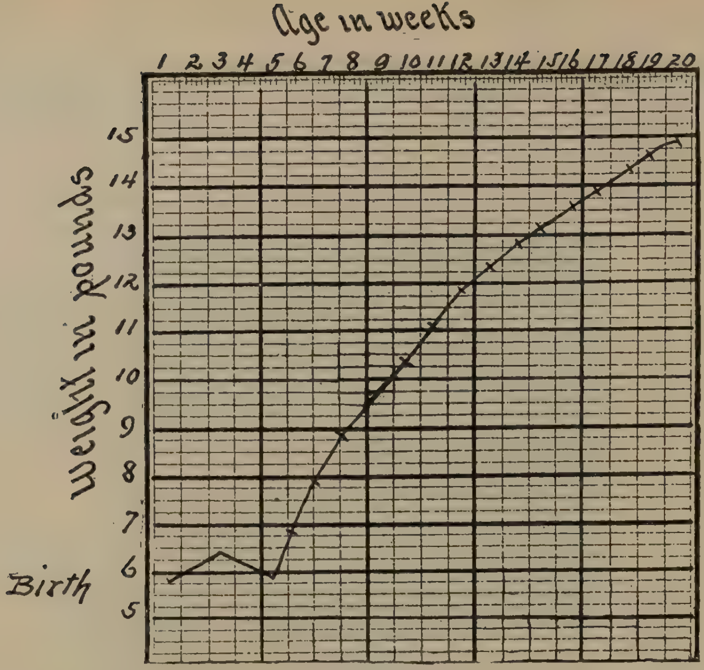

Fig. 40.

Baby J. S. Born prematurely. Weighed 5 pounds 14 ounces at birth. Was bottle-fed. Vomited; had dyspeptic symptoms, such as cheesy stools, restlessness at night, crying continually, and excoriated anus. When 1 month old the weight, including shirt and diaper, was 6 pounds. A wet-nurse was procured. The child gained 1 pound during the first week, and an average of 10 ounces a week thereafter. Dyspeptic symptoms disappeared; stools became normal.

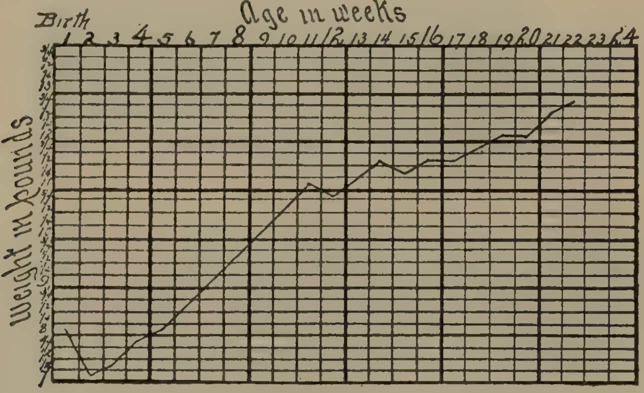

Fig. 41.

Baby fed on Eskay's food since end of third week. General condition satisfactory, although somewhat constipated.

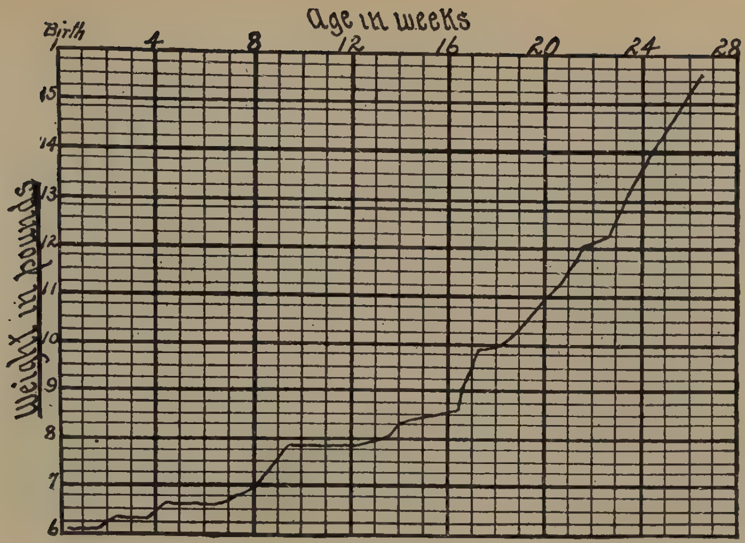

Fig. 42.

Baby A. Case of chronic dyspepsia. Child 4 months old. Weighed 8 pounds 15 ounces. Gained 13 ounces the first week of treatment; 6 ounces the second week; 7, 12, 9 ounces respectively during each of the succeeding weeks.

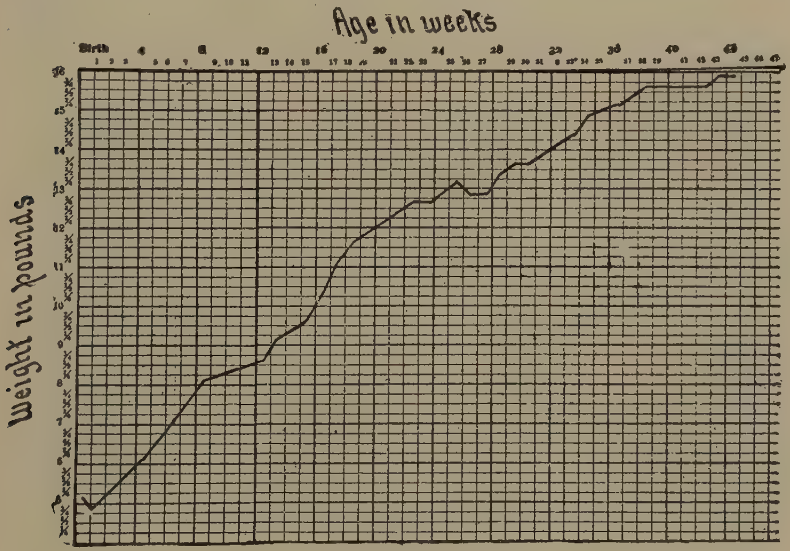

Fig. 43.

Baby D. S. Weighed 5 pounds at birth. Was fed at Walker-Gordon Laboratory since 6 weeks old. Lost weight during an attack of measles when 26 weeks old. Did not gain one ounce from the thirty-eighth to the forty-second week, although received a formula of:—

Fat	4.00
Sugar	6.50
Protein	2.50

Six feedings, of 7 ounces each.

I ordered the following home modification:—

Raw milk	6 ounces.
Barley water	2 ounces.
Mellin's food	2 teaspoonfuls.

Feed every three hours.

In addition thereto I ordered one ounce of steak juice or one ounce of orange juice, daily, one hour before feeding.

I also gave the white of one raw egg with the evening feeding. The food agreed very well and child gained in weight as I gradually added more milk and reduced the quantity of barley water.

A growing child needs far more food than its weight alone would indicate, for its income must exceed its expenditure so that it may grow.

The diet of the infant is nearly twice as rich in proteins, half as rich again in fats, and a little more than half as rich in carbohydrates as that of the adult. It is, therefore, in a physiological sense a luxurious diet.

The strain of growth falls heavier upon the more precious proteins than upon the more cheap and common carbohydrates.

When children do not gain in weight, the quantity of sugar should be increased. This should be done continuously and with due consideration for the other ingredients.

The constructive ingredient in an infant's food is the protein. We must also consider this element when an infant's weight is stationary.

Individual conditions must be considered, and chronic disorders eliminated, *e.g.,* dyspeptic conditions or tuberculosis, before arriving at a diagnosis of what really causes an infant's loss in weight.

DENTITION.

Dentition is a physiological process. Teeth are developed at birth and grow with the infant until they pierce the gum. A series of nervous disorders occur after the fourth month and during the eruption of the teeth. Such symptoms are a very warm mouth, red and inflamed gums, and an excessive secretion of saliva. Rachitic children and those having a highly sensitive nervous system will be very restless at night. They will roll the head and frequently cry with pain. A finger will usually be found between the gums, and the child will try to bite everything within its grasp. These symptoms disappear after the eruption of the tooth, so there seems to be some relation between the tooth and the symptoms described. Rotch states that in certain infants, during the completion of the development of a tooth, symptoms connected with the ear will manifest themselves. The symptoms are usually produced by a congestion of the blood-vessels of the ear which is accompanied by pain and sometimes results in an inflammation.

Treatment of Inflamed Gums.—When the gums are tense and inflamed, severe nervous manifestations frequently exist. An incision to aid the eruption of a tooth is obsolete and unnecessary. There is danger of an infection and this practice should be warned against. The local application of a 1 to 5000 solution of adrenalin acts very well. It may be repeated every hour. A drop of laudanum on absorbent cotton placed in the middle ear seems to act well in some instances. In rare instances we will be told that a child has had convulsions. In such, meningitis may be present. I must emphatically reiterate that such cerebral or nervous symptoms are apt to occur in the sick infant, and will never occur in the healthy infant.

The association of bronchitis or diarrhea must be looked upon as entirely independent of dentition. The laity are very willing to ascribe most disorders arising at or about the period of dentition as due to the teething. The following case will illustrate how careful one must be not to be guided by the statements of the laity and diagnose dentition:—

A child, 15 months old, was seen by me in consultation. This was a well-nourished, breast-fed infant, and had four incisors, two upper and two lower. The mother stated that the child had had a cough and fever at and before the appearance of each tooth. She was very emphatic in stating that her baby was "teething." There were anorexia and slight constipation. A dose of castor oil was given, but the symptoms continued. The child was very thirsty and seemed to lose flesh. The temperature in the rectum was 103° F., pulse 150, respiration 30. An examination of the chest showed moist râles and quite diffuse rhonchi. There was a marked area of dullness and bronchial breathing in the upper lobe of the right side. The diagnosis of pneumonia was made. Four or five weeks later I again saw this child. The cough still existed, and a suspicion of whooping-cough was expressed. An exploratory puncture showed pus. The diagnosis of empyema was made. The child was operated upon and made a brilliant recovery.

The teeth usually appear between the third and tenth months. The usual rule is for normal dentition to begin about the seventh or the eighth month.

In a great variety of children premature teething is recorded; I have seen a great many children born with two or more teeth.

Rachitic children, as a rule, teeth very early or very late. In the large children's service with which I have been connected I have observed the eruption of teeth many times as early as two or three months in very rickety, bottle-fed children. These teeth soon decay, and are then known as carious teeth.

In syphilitic children premature dentition is frequently seen.

The first teeth are known as *milk-teeth.*

The following table will show the usual rule followed by normal dentition in the average child:—

TABLE NO. 27.

19	11	13	5	3	4	6	14	9	17
20	12	15	7	1	2	8	16	10	18

The milk-teeth are twenty in number; thus, one and two are the lower incisors, usually first teeth; then follow three and four, upper incisors.

Normal children usually teeth in pairs, and not singly, whereas rachitic children usually have an eruption of single teeth, and distinct backwardness in their appearance. Deciduous teeth, commonly called milk-teeth, remain until a child is 6 years old, when the permanent teeth appear.

Baginsky emphasizes the fact that enough stress is not laid on the clinical importance of carious teeth as indicating tuberculosis and scrofulous conditions. In the section on treatment of rickets I have mentioned the value of a nitrogenous and salt diet to aid in the formation of bony structures. The teeth are also included in this category.

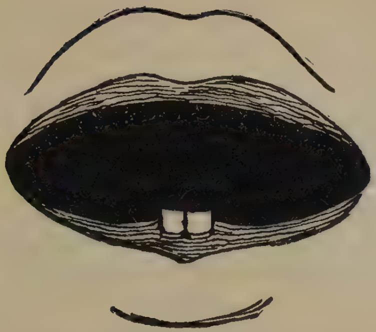

Fig. 44.—Two middle lower incisors. Three to ten months; Average, seven months.

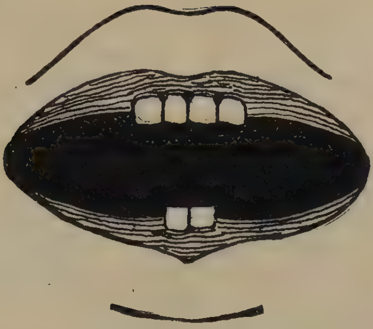

Fig. 45.—Four upper incisors. Nine to sixteen months.

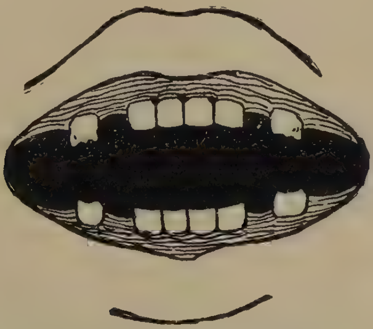

Fig. 46.—Two lateral lower incisors and four anterior molars. Thirteen to seventeen months.

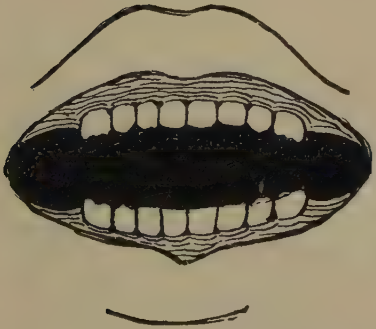

Fig. 47.—Four canines. Sixteen to twenty-one months.

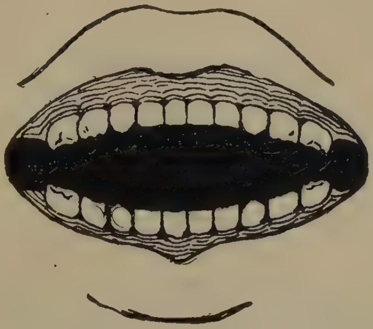

Fig. 48.—Twenty milk teeth. Twenty-three to thirty-six months, although the average is twenty-four to thirty months.

Thus, when such drugs as codliver oil or iron and hygienic measures are indicated for the treatment of rickets they are of especial value when backwardness in teething exists.

When diarrhea or cholera infantum cleanses the system and when the disease is arrested or well under way, normal physiological conditions, such as dentition previously delayed, are vigorously continued. *Frequently teeth will appear immediately following such an acute disease; thus, an apparent delayed dentition, due to a pathological process, will be attributed by the laity to the disease or sickness called teething.*

IV.

DIAGNOSTIC SUGGESTIONS.[1]

It is a very difficult matter to give as distinct clinical pictures of children in certain diseases as we can of adults. The following points are important enough to be noted:—

First.—There is an absence of expectoration in respiratory diseases. Infants cough and usually swallow their expectoration.

Second.—An absence of distinct chills and rigors as seen in adults.

Third.—The tongue, so valuable in adults as an aid to diagnosis, may frequently be overlooked as a symptom of importance in young children.

Fourth.—Very high temperature and pulse-rate may be associated with trivial, just as well as they only too frequently denote serious conditions. A normal temperature is frequently seen in septic diphtheria; we must, therefore, not judge a case by the temperature alone.

Fifth.—The great peristaltic activity and the anatomical difference in the shape of the stomach at birth render such symptoms as vomiting and diarrhea trivial compared with what such symptoms would denote in an older and fully developed child.

West ably says: "You cannot question your patient, or, if old enough to speak, still, through fear, or from comprehending you but imperfectly, he will probably give you an incorrect reply. You try to gather information from the expression of his countenance, but the child is fretful and will not bear to be looked at; you endeavor to feel his pulse, and he struggles in alarm; you try to auscultate his chest, and he breaks into a violent fit of crying." Such technical difficulties each medical man must try to overcome, and here it is that the ingenuity of the practicing physician is brought into play.

There are a great many important points which have a bearing upon the diagnosis and which it is well to formulate: First, try to examine the infant when asleep. Note the color of the face, if flushed or pale; the color of the lips, if white or cyanotic; the condition of the skin, if dry or moist; if perspiration is confined to the head or forehead, or if it affects the whole body. Second, note the frequency and character of respiration, if painful or natural; moaning, twitching, or grinding of teeth; the action of the nostrils, if quiet or dilating; the eyes if closed, partly closed, or staring. Third, note the condition of the fontanels, if closed or open, if pulsating, if distended, full, and bulging, or if sunken.

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[1] The Babinski reflex, Kernig's sign, tâche cerebrale, and the technic of lumbar puncture are described in detail in the chapter on Meningitis, Part IX, Vol. ii.

The pulse-rate should be noted. In counting the pulse-rate certain allowances must be made for excitement. The sudden slamming of a door, etc., will startle infants and cause the pulse to increase at times from ten to twenty beats.

The pulse varies in infants from 110 to 150. It may be irregular, consistently with health. After the seventh year it is found to be quicker in the female. It is sometimes slower during sleep. A very slow pulse is not always an indication of cerebral disease.

In a study of over 1000 children in health, the following average table of pulse was found:—

TABLE NO. 28.

At birth	130 to 140
First year	115 to 130
Second year	100 to 115
Third year	90 to 100
Seventh year	86 to 96
Fourteenth year	84 to 94

TABLE NO. 29.

	Pulse Rate:	
	While Asleep.	*Awake, Crying.*
Infant ten days old	146	164
One month old	150	176
Two months old	120	150
Three months old	112	148
Six months old	98	122
One year old	100	120
Two years old	98	108

A diagnosis can frequently be made by the condition of the pulse-rate added to the general condition. If a child is suddenly taken ill with fever, with symptoms of nausea and vomiting, a dry coated tongue, and the pulse-rate about 130, we may look for an acute gastric fever. Such is usually the case if the history points to a diet of cake and pie, or meat, in a very young child.

If, however, the child is feverish and vomits and the pulse-rate is between 70 and 80, then we should suspect tubercular meningitis rather than an acute febrile disease. Note the condition of the child's awakening; every young infant in a healthy condition awakens with a smile, does not frown, is not peevish.

Frequently, if the clinical history is looked into, we can learn just when the infant first became restless or showed some sign of disturbance. This will usually mark the beginning of an illness, if the same is an acute condition.

The Respirations.—From 1 to 2 years of age a child should breathe from 24 to 36 times a minute. The breathing should be diaphragmatic in character; in ordinary breathing there should be no recession of the chest walls; this occurs in sobbing or if a mechanical impediment exists to the entrance of air into the lungs.

The number of respirations per minute ranges from 30 to 50; in early infancy 39 is the average.

Table No. 30.

From two months to two years, the average is 35.
From two years to six years, the average is 18 during sleep, 23 awake.
From six years to twelve years, the average is 18 during sleep, 23 awake.
From twelve years to fifteen years, the average is 18 during sleep, 20 awake.

Temperature.—The normal temperature of the child, taken in the rectum, varies between 99⅗° and 100° F. Fever undoubtedly exists if temperature over 100° F. is noted. The cause should be searched for. No indication is more simple or more valuable than that supplied by the thermometer. By its aid alone we are often led to suspect the advent of typhoid or scarlet fever, or to detect some latent pneumonia, or tubercle producing irritation, or some other malady which we had overlooked. It should be remembered that *rigors* do not occur in very young children, but that *convulsions and delirium* correspond in a great measure to *rigors and headache* in an adult. The temperature is an important guide as to the condition of an infant. The pulse-rate and the character of the pulse are even more important.

Finlayson has bestowed much attention on the subject of temperature in young children, and his observations go to show:—

1. That there is a fall of temperature normally in the morning of 1°, 2°, or even 3° F.

2. This fall may take place before awakening.

3. It is usually highest between 7 and 9 P.M.

4. The minimum is at or before 2 A.M.

5. After 2 A.M. it again rises, and that independently of food, etc., being taken—rises, in fact, during sleep.

6. The fluctuations between breakfast and noon are usually trifling.

Rules to be Observed in Taking Temperature of Infants.—1. Be sure you have a good thermometer.

2. Inspect it and see that it is well shaken down to below normal before using it.

3. Anoint it with vaseline or oil.

4. Always use the rectum for infants.

5. Remember that infants always object to being disturbed; hence the thermometer should be watched; otherwise an accident may happen.

6. The best position for the child is to lay it face downward on the nurse's lap.

7. Remember that impacted feces in the rectum and fermentative conditions usually increase the temperature.

The Eye.—Squinting in acute illness is a grave symptom; it may occur from reflex irritation, or from paralysis, or from convulsions, but the convulsions may cease and the squint remain for awhile or even permanently. When strabismus occurs in tuberculous meningitis, it is usually a fatal sign.

A small pupil is not so commonly seen as a large one; it occurs in active congestion, in opium poisoning, and in sleep. It should be remembered that the eye is always more or less turned up beneath the upper lid. Large pupils, if equal in size, are only of grave import when insensible to light; inequality of the pupils coming on in acute illness is a very grave sign. Jadelot has noticed that the form of the pupil is irregular in children suffering from the intestinal irritation of worms.

Prophylaxis and Treatment of the Eyes in the Newly Born.—The vaginal discharge of a pregnant woman contains pathogenic bacteria. This frequently gives rise to an infectious catarrh in the newly born. It is therefore important to treat the eye of the newly born baby with extreme care to prevent an infection which can produce serious results. Ordinarily the eyes should be washed with a pledget of sterilized cotton dipped in plain sterile water or a 2 per cent. boric acid solution. The mouth and nose should be similarly treated. All cotton used for the hygiene of the mouth, nose, and eye should be burned immediately after use.

Credé advises the use of a 1 per cent. solution of nitrate of silver. One drop (no more than one drop) is allowed to drop from a solid glass rod or a medicine dropper on the center of the cornea. Its object is to prevent the infant from acquiring ophthalmia neonatorum.

The prophylaxis of blindness is worth studying. The New York Association for the Blind reports many cases "of needlessly blind victims of ophthalmia neonatorum." The official census of the blind for the State of New York for 1906 gives a total of 6200, out of which number 1984 were preventable blindness, most of them caused by ophthalmia neonatorum.

Garrigues[1] states that in lying-in asylums before this treatment was adopted, purulent ophthalmia was very prevalent.

Statistics show that one-half to two-thirds of those affected with blindness lost their sight from this cause.

When the frequency of the gonococcus in the vaginal secretions of women delivered in lying-in asylums is considered, then the wisdom of prophylaxis cannot be questioned.

Of late protargol (10 per cent. solution) has been substituted for the nitrate of silver solution. It is just as effective and less irritating.

Solution argyrol (20 per cent.) is very useful in the catarrhal affections of infants and children. I have seen very good results during my service at the Willard Parker Hospital with the same.[2]

The following aphorisms are of practical value:—

1. In early childhood there is no relation between the intensity of the symptoms and the material lesion. The most intense fever, with restlessness, cries, and spasmodic movements, may disappear in twenty-four hours without leaving any trace of having been present.

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[1] Henry J. Garrigues: "Textbook of Obstetrics," 1902.

[2] See also Part X, Vol. ii, Diseases of the Eye.

2. Abundant perspiration is not observed in very young children.

3. Fever always presents considerable remissions in the acute diseases of young children.

4. In the chronic diseases of infancy, fever is almost always intermittent.

5. When children are asleep their pulse diminishes from 15 to 20 beats. The muscular movements which accompany cough, crying, agitation, etc., raise the pulse 15, 30, or even 40 pulsations.

6. The diseases of youth always retard the process of growth.

It is a good plan to percuss the chest before resorting to auscultation. The back of the chest is the most important to auscultate in a sick child. If there are no physical signs pointing to bronchitis or pneumonia in the back of the lungs, then it is unlikely that the front of the chest will show any signs. To be sure, however, both back and front of chest should be examined.

Dullness on the right side in the region of the 7th to 10th ribs posteriorly is a normal physiological condition, according to Vogel. Owing to abdominal pressure the abdominal organs, and notably the liver (as especially affecting the right side), is pressed upward.

Gestures are often significant. In brain disease the child puts its hand to its head, pulls at its hair, rolls its head on the pillow, and beats the air. In abdominal disease the legs are drawn up, the face is sunken and anxious, and the child picks at the clothes. In urgent dyspnea it tears at its throat or puts its hand in its mouth, especially when false membranes are forming, or the tongue is much furred, as in fever.

In earache the child puts its hand to its ear and we hear a constant whining or cry. If the pain is severe, a piercing cry, almost continuous, will be heard. Fever always accompanies otitis.

The cry varies; it is labored, as if half suffocated, or as if a door were shut between the child and the hearer, in pneumonia and capillary bronchitis; it is hoarse in croup, brassy and metallic, with crowing inspirations; in cerebral disease, especially in hydrocephalus, it is sharp, shrill, and solitary, the so-called "cri hydrocephalique," whereas in marasmus and tubercular peritonitis it is moaning and wailing. Obstinate and *long-continued crying* lasting for hours is referable usually to one of two causes; *earache* or *hunger*. A louder, shriller cry, also on coughing or produced in moving the child is pleuritic. A cry accompanied with wriggling and writhing and preceding defecation is intestinal. M. Billard distinguishes between the cry and the return, the cry proper being the expiratory act, while the return occurs during inspiration. The cry proper is sonorous and prolonged; the return is shorter and sharper; the return is feeble in young infants, but increases in strength as the child grows older. It is the return that grows weak or ceases toward the end of all diseases. Moaning is especially characteristic of pain in the alimentary canal.

The Tongue.—The following are the chief indications derived from observations of the tongue: 1. A furred tongue with whitish fur scattered over it indicates dyspepsia and intestinal irritation. 2. A red, dry, hot tongue points to inflammation of the mouth, stomach, etc. 3. Aphthæ often result from sheer starvation and neglect. 4. A pale flabby tongue marked at the edges with the teeth shows great debility. 5. White fur is generally indicative of fever. 6. Yellow fur of liver and stomach derangement of long standing. 7. Brown fur of a low typhoid condition. Besides these, special conditions, as the "strawberry tongue" of scarlatina, the glazed tongue of dyspepsia, etc., will be noted under the special diseases they characterize.

The Throat.—*No matter what the child suffers with, it is imperative to examine the throat.* Advantage can be taken of the infant while crying to observe the tongue, the teeth, the gums, the mouth in general, and the throat in particular. The neglect of an examination of the throat has frequently been the means of overlooking diphtheria. Many a child's life has been sacrificed by failure to make a minute examination of the throat.

Sleep.—Healthy infants normally sleep from eighteen to twenty hours out of twenty-four. Thus, if infants are restless and do not sleep, such insomnia denotes illness.

Presuming that we have had an opportunity to examine the infant during sleep, let us then have the child undressed and notice the surface of the skin; it should be mottled, the flesh firm, the skin smooth and elastic to the touch, and not flabby; there should be no impediment to the motion of either the arms or legs, they should move freely; the joints should be noted if they are swollen, if large or small; the epiphyses of the long bones should be carefully noted, and evidences of rickets

TABLE NO. 31.—DEATHS AND DEATH RATES FROM ALL CAUSES UNDER TEN YEARS OF AGE, PER 1000 OF THE POPULATION, CITY OF NEW YORK, 1916 TO 1920, INCLUSIVE.[1]

Year.	Under One Year		1 to 2 Years.		2 to 3 Years		3 to 4 Years.		4 to 5 Years		Total Under 5 Years		5 to 9 years Inclusive	
	Deaths.	Rate.	Deaths.	Rat	Deaths.	Rate.	Deaths	Rate	Deaths.	Rate	Deaths.	Rate.	Deaths.	Rate.
1916	12,818	93.1	3,578	33.2	1,748	14.9	1,090	9.1	733	7.0	19,967	34.5	1,949	4.0
1917	12,568	88.8	3,092	28.2	1,203	10.1	788	6.9	614	5.8	19,265	31.1	1,706	3.4
1918	12,657	91.6	4,302	38.6	1,879	15.5	1,284	11.1	897	8.3	21,019	35.4	2,546	5.0
1919	10,639	81.8	2,453	21.7	1,192	9.7	809	6.9	651	5.9	15,744	26.5	1,872	3.6
1920	11,340	85.4	3,205	27.9	1,349	10.8	777	6.5	617	5.6	17,288	28.6	1,831	3.5

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[1] Prepared by the Division of Statistical Research Bureau of Records, April 18, 1921.

[2] Rates under one year based on number of living births reported.

determined, as this has an important bearing on various infantile diseases.

I have previously called attention to the necessity of undressing a child for its proper examination. Fever which cannot be explained may, upon examining the surface of the body, be readily understood if a scarlet fever rash is seen. This can only be detected by undressing and examining the infant.

PROGNOSIS.

In giving an opinion as to the probable outcome of a given case, we must be guided by the following conditions: Has the infant a good foundation—been breast-fed in infancy—or are we dealing with a marasmic or rachitic infant? The resistance offered to the acute infectious diseases by an infant nursed at the breast is most probably due to the antitoxic virtues found in the milk. The temperature should not always be the guide. Infants respond very quickly to disease and show very high temperatures. They are more susceptible to infections than adults. A high fever may appear and disappear very suddenly; hence we should not base our prognosis on the sudden appearance of temperature. The pulse—the heart action—is our best guide in estimating the outcome of a given case. The amount of food taken during an illness and the digestion and assimilation of the same are important factors in estimating the condition of the patient. Constant fever, loss of appetite and sleep, with resulting heart weakness, should be regarded as symptoms of a critical condition.

INFANT MORTALITY.

Through the vigilance of the health department New York City has secured a good milk supply. The feeding of impure milk was always considered the reason for the high infant mortality, especially during the summer months. Although the mortality has been greatly reduced there is still room for improvement. The infant mortality in infectious diseases has also been greatly reduced. This is largely due to the immunizing injections of antitoxin and the more generalized use of antitoxin as a preventive measure.

The statistics of the mortality in diphtheria, scarlet fever, and measles show a reduction in the mortality of 10 to 20 per cent. during the last twenty years. The beneficial change has been largely due to three factors: First, the better milk supply; second, preventive measures, such as immunizing doses of antitoxin to prevent diphtheria after exposure, and, third, to fresh air—this implies windows open, new parks, roof gardens, and education of the masses to a proper understanding of the virtues of fresh air in health, and especially in disease.

The public is learning to appreciate the benefits of open-air classes for the anemic children in the public schools. Roof-garden instruction and the strict supervision in public schools, due to the efficiency of medical inspectors, have lessened contagion among school children. The parents of children suffering with adenoids and diseased tonsils are notified and advised regarding their danger. The open-air treatment of tuberculous joints established by the Society for Improvement of the Condition of the Poor and heliotherapy have accomplished excellent results at Coney Island and elsewhere. Such therapeutic measures prolong life and reduce mortality.

TABLE NO. 32.—TWO HUNDRED DEATHS—THEIR MODE OF FEEDING.
INQUIRY INTO 200 DEATHS.

Age in Months.	Cases Investigated.	On Breast Only.	On Breast Partially.	Bottle Feeding Only.
0- 3	78	5	8	65
3- 6	30	7	12	11
6- 9	64	12	16	36
9-12	28	9	12	7
	200	33	48	119

The above children were inhabitants of both the East and West Side of New York City, living in crowded apartments. The hygienic factor is, therefore, an important one. Sixty per cent. of these children died from gastric and intestinal disease. About 30 per cent. died from catarrhal diseases affecting the air passages, such as bronchitis, pneumonia, and tuberculosis. The rest died from infectious diseases and surgical accidents.

V.

ROENTGEN RAY EXAMINATION.

In the radiographic examination of children, rapid exposures must be made, since the respiratory and other movements of the child cannot be controlled. With modern apparatus and intensifying screens, very satisfactory exposures can be made in $\frac{1}{15}$ second. Every chest and gastrointestinal case should be fluoroscoped. Infants should be strapped to a canvas frame or to a board so that there will be greater ease in securing a fluoroscopic picture. Fractures should be radiographed and not fluoroscoped, as fissured fractures are often impossible to detect under the fluoroscopic screen.

Great care must be taken to insure proper protection to both patient and operator. The operator should wear a leaded apron, gloves and glasses and the fluoroscopic upright and the tube should be equipped with filters.

Any Roentgen ray examination can be made at the bedside or in the patient's home now that portable apparatus is readily procurable.

CHEST, LUNGS, AND HEART.

Examination of the chest begins with fluoroscopy in the upright position. The observer should make a careful survey of the pulmonary fields and of the cardiac shadow. Then plates are made in the postero-anterior position and in the antero-posterior. The child must be held in a plane exactly parallel to the plate; otherwise the cardiac shadow will be projected to one side and one pulmonary field will be foreshortened and the other elongated. The slightest tilt from an exactly parallel plane will produce an inaccurate image on the plate. The pulmonary fields should be clear and show hilus markings. The hilus or root markings are due to superimposed shadows of bronchi, arteries, veins and lymphatics. Rather extensive hilus markings are within normal limits.

Clouding or diminished illumination of a portion of the pulmonary field (*i.e.*, white area on the plate or film) points to something denser than normal lung and may be due to consolidation, inter-lobar abscess or pleural effusion. Absence of lung markings means pneumothorax, and with this there is usually a circumscribed area of clouding due to the accompanying collapsed lung. Hydro-pneumothorax will show a straight fluid level if the plate is taken in the upright position, and if taken in the horizontal position the entire field will be clouded. Generally, in pleural effusion the lower portion of the pulmonary field is clouded, and the area of diminished illumination has a concave upper border, and shows no change on change of position.

In lobar pneumonia an entire lobe area is clouded, and if an upper lobe, usually is sharply demarcated. In the usual type of lobar pneumonia resolution takes place from the periphery and the clouded area shrinks from day to day. In cases of delayed resolution we have central absorption and the last part to disappear is the periphery.

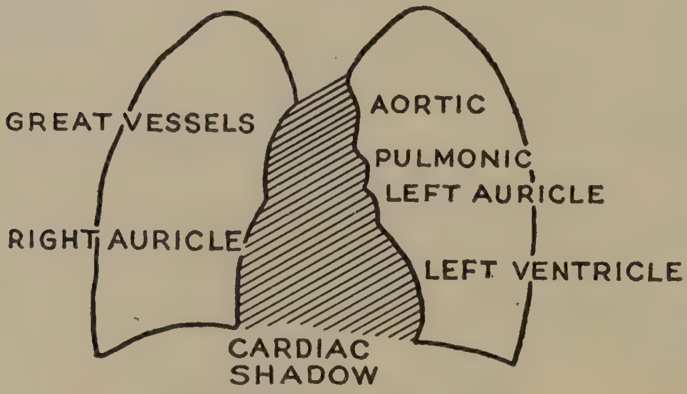

Fig. 49.—Normal cardiac shadow.

Bronchopneumonia shows a mottling of both pulmonary fields. The mottling seen in tuberculosis is finer and extends to the periphery.

Calcified lymph-nodes at the roots of the lungs are rather frequent and do not have the importance formerly attached to them. If, however, they are large and numerous, a hilus tuberculosis may be suspected, but a few caseous or calcified lymph-nodes are not infrequently found in apparently healthy city children.

Heart.—The normal cardiac shadow has two curves on the right side and four on the left. See Fig. 49.

The right ventricle does not show on the plate, normally.

During the first two years of life, only two curves are present on the left side. The pulmonic curve cannot always be demonstrated.

The cardiac shadow may be enlarged and show one of several types of changes. The double mitral type shows an enlarged cardiac shadow, especially of the lower part.

The aortic type shows an enlargement of the left ventricle but not of the auricle, and the arch is wider than normally.

In pericardial effusion the cardiac shadow has the appearance of a truncated pyramid, with obliteration of the cardio-diaphragmatic angles.

The normal size of the cardiac shadow for a given child can be determined by referring to tables which have been carefully worked out with reference to *age, height, weight,* and *sex.*[1] These are all factors which determine the varying sizes of the cardiac shadows.

Thymus.—The examination of the chest is not complete without a picture of the thymus. An enlarged or persistent thymus can be demonstrated with proper technic. Care must be taken to differentiate an enlargement of the thymus from distended vessels and enlarged mediastinal glands.

STOMACH.

The stomach is examined after ingestion of a mixture of barium sulphate and malted milk or formula milk. About half an ounce of barium sulphate in several ounces of milk is given to infants in the feeding bottle. Older children are given larger doses. Only barium sulphate, C.P. and. for x-ray diagnosis, should be used. It may be necessary to introduce this mixture through the stomach tube.

After having fluoroscoped the child to observe the size, shape and position of the stomach, as well as the tone and peristaltic movements and the emptying rate, plates are made at half hour intervals for several hours. A large residue at the end of three hours means an organic obstruction or a pyloric spasm. To differentiate, re-examination after the administration of antispasmodics may be of value. An obstruction in any portion of the small intestine may be noted by the distention of the proximal loops.

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[1] Reyher: Das Roentgenverfahren in der Kinderheilkunde.

A lesion of the large bowel, such as Hirschsprung's Disease can be easily demonstrated by radiographing after a barium sulphate enema.

TEETH.

Teeth are often the primary focus of a systemic infection. If a systemic infection recurs and no cause for it can be found, then the teeth should be suspected as being the etiological factor and should be x-rayed.

The pus from suppurating teeth can readily mix with the saliva and be swallowed with the food, and so can be a source of infection.

Sinuses and the antrum of Highmore may, by direct extension, become infected from adjacent infected teeth.

Examination of the teeth of infants and children up to the age of five years is often unsatisfactory.

Pus in the frontal sinus or in the antrum shows on the plate as a clouded area. In children especially, several examinations should be made since the antrum may empty or refill between two examinations.

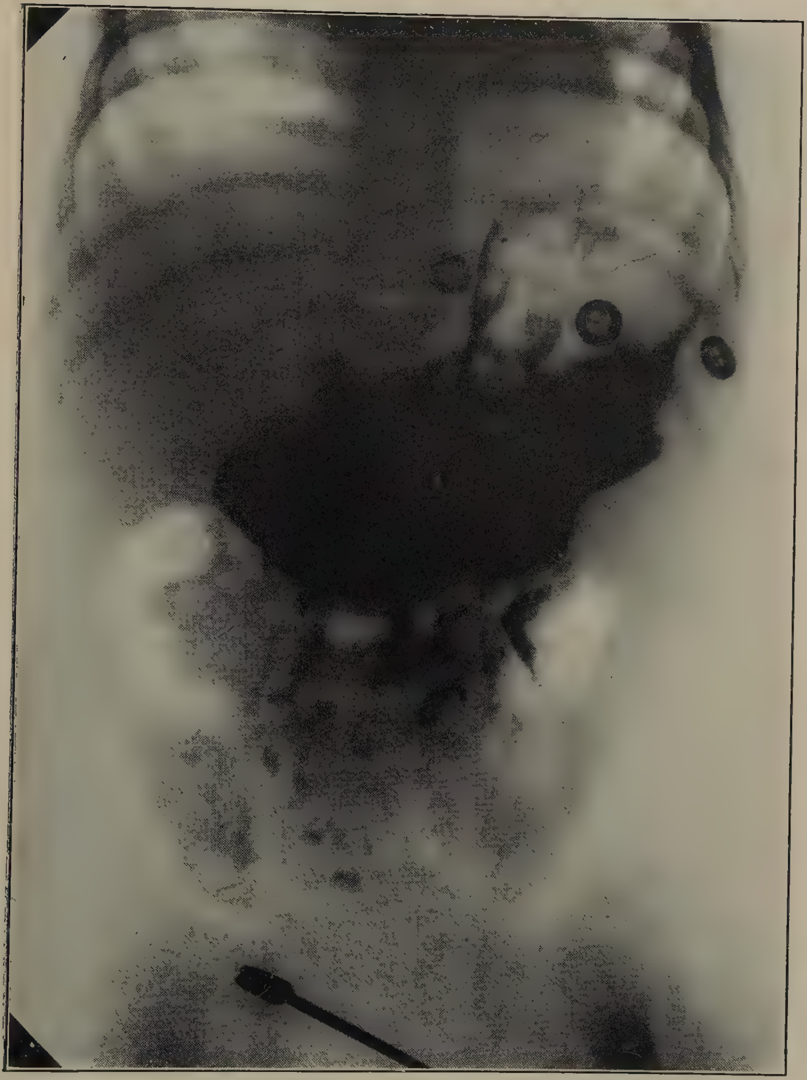
URINARY TRACT.

The examination of the urinary tract in children is carried out in the same way as for adults, except that the exposure time is much shorter. Thorough catharsis is essential before the proper radiographic examination can take place. On the evening before the examination the child is given castor oil or another cathartic, but not salts or pills, for salts draw water to the bowel and produce gas, and pills if not completely broken up may cast shadows. On the morning of the examination an enema is given and no breakfast.

Bladder calculi are not uncommonly found; and every case of so-called interval appendix should be thoroughly radiographed for a possible calculus in the lower end of the right ureter. In several cases after the appendix was removed and the symptoms recurred, a radiograph showed a small calculus in the lower end of the right ureter.

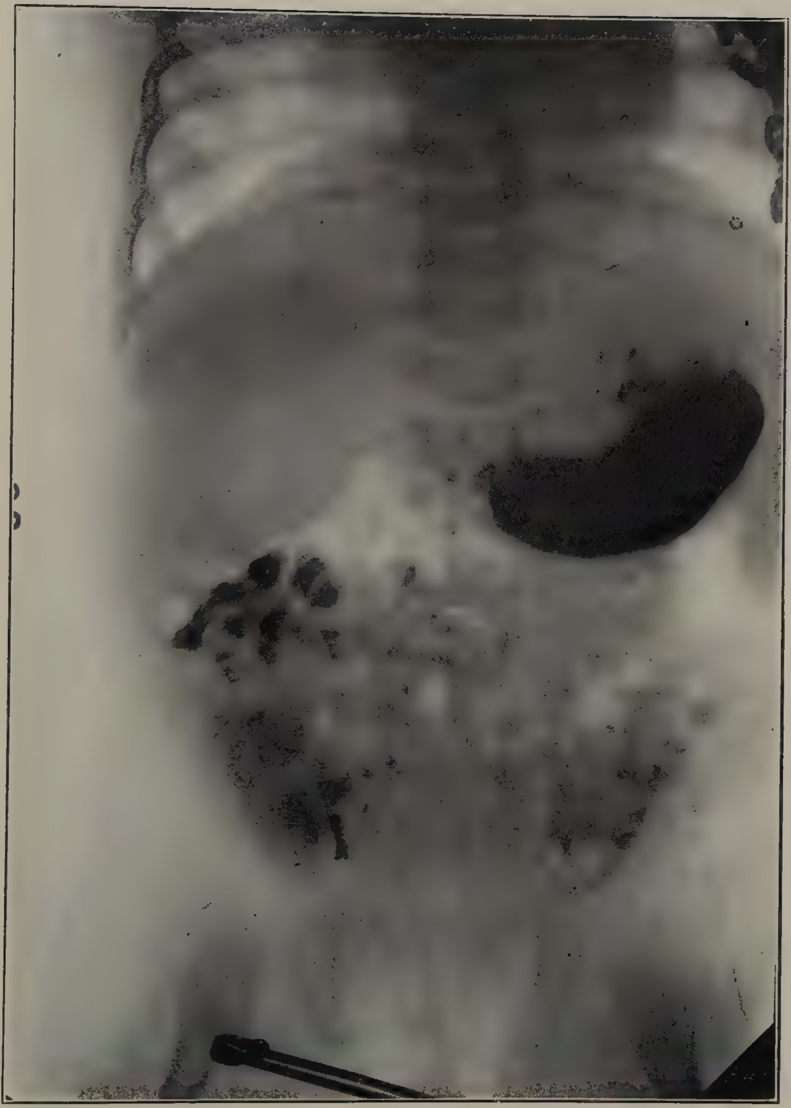
The size and shape of the bladder lumen and also of the lumen of the kidney pelvis and calyces can be well outlined by

PLATE VII



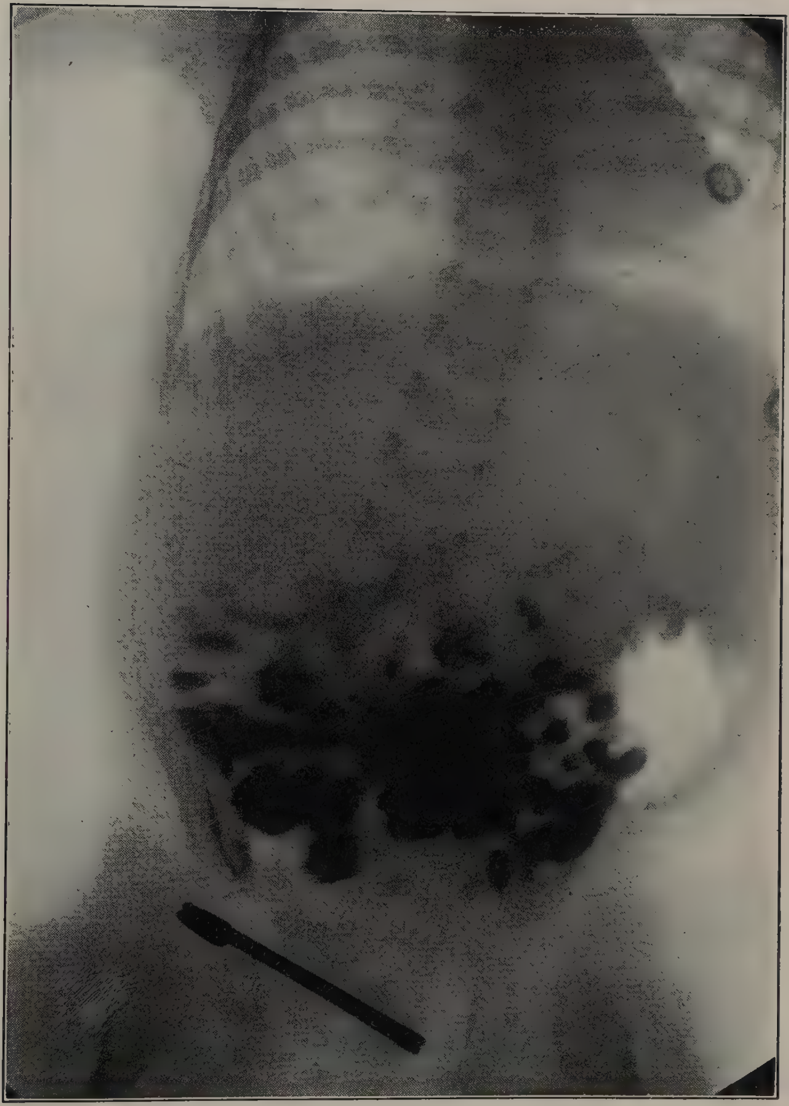
Stomach immediately after the ingestion of barium meal.

PLATE VIII



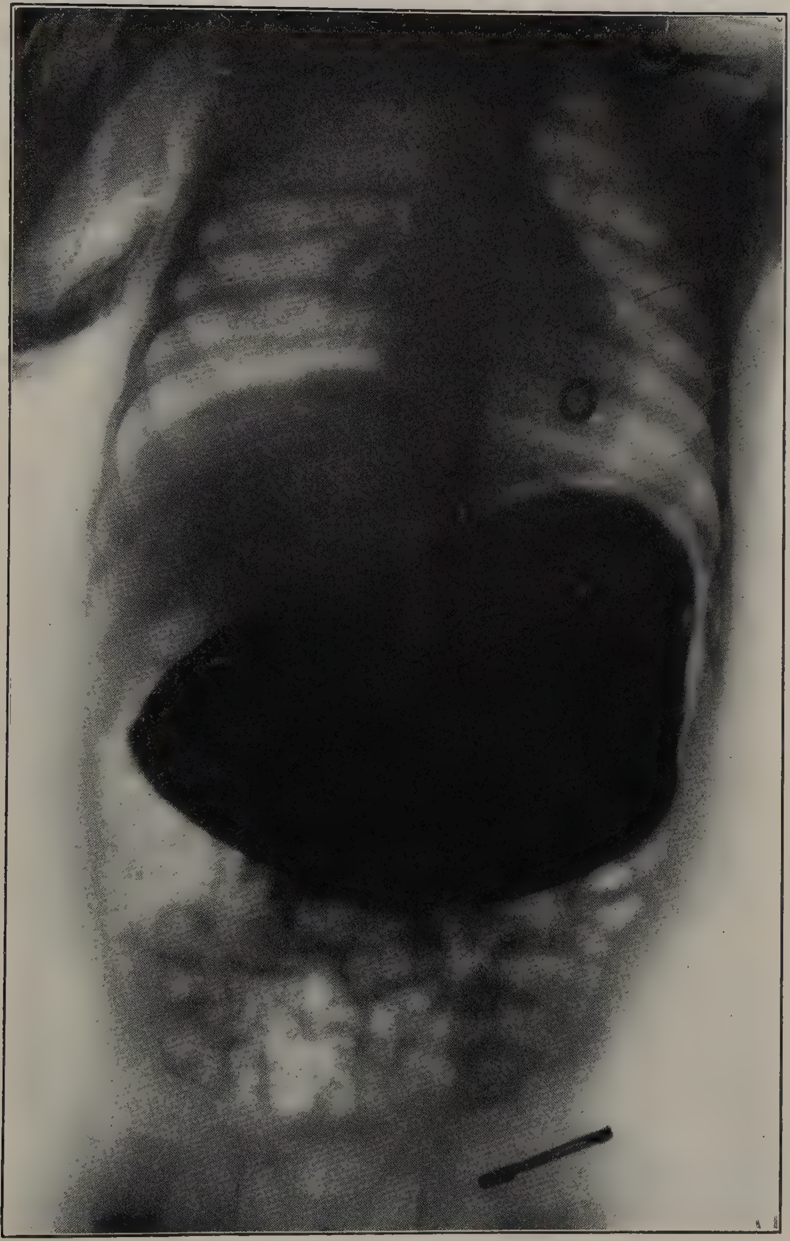
Same case as Plate VII. One hour after meal.

PLATE IX



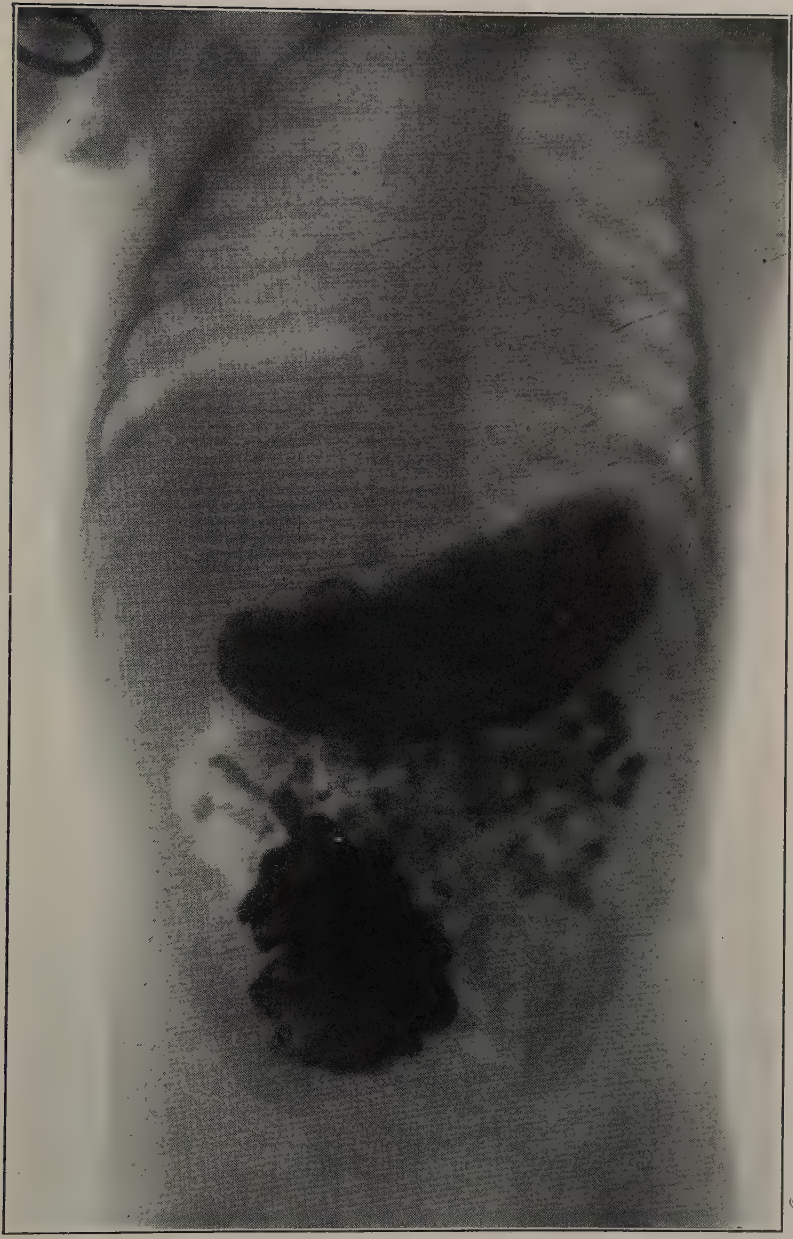
Same case as Plate VII. Three hours after meal. Stomach empty. No residue. Shows normal condition.

PLATE X



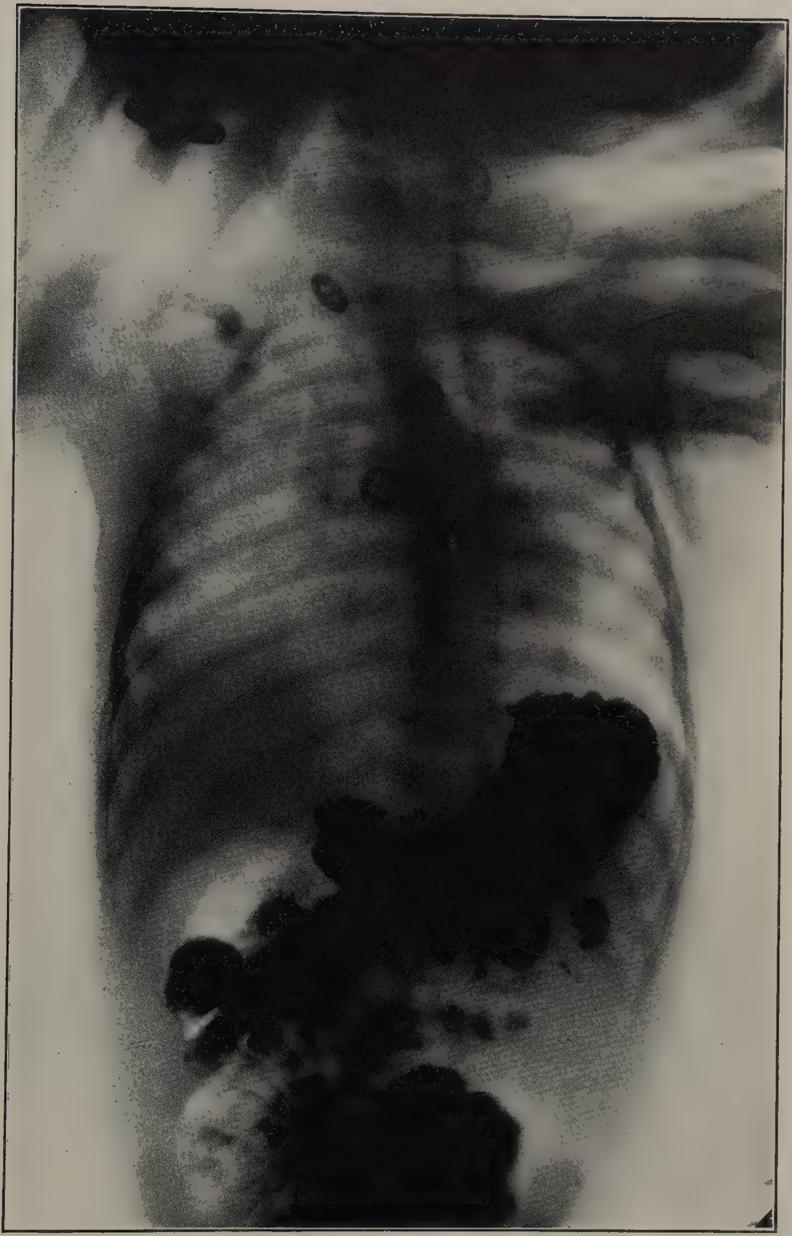
Pyloric spasm. Stomach immediately after ingestion of the barium meal.

PLATE XI



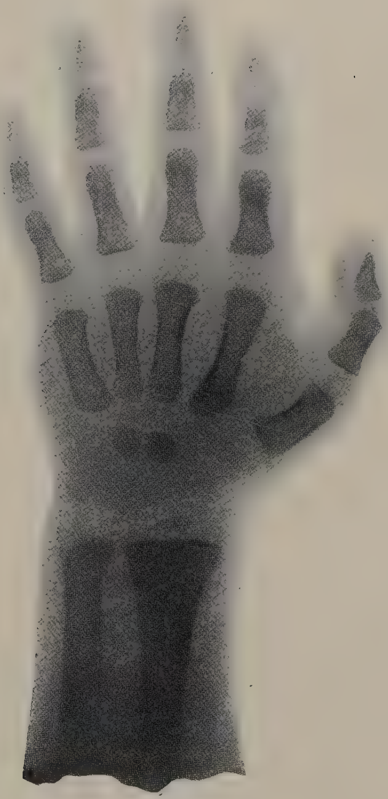
Same case as Plate X. Two hours after ingestion.

PLATE XII



Same case as Plate X. Three hours after ingestion of the barium meal. Note the residue, indicating either pyloric stenosis or pyloric spasm. Compare with preceding series.

PLATE XIII



Hand of cretin. Seven years old. Centers of two carpals are present which would indicate age two years. Seven centers should be present normally at age of seven.

radiographing after the injection of an opaque substance such as 20 per cent. sodium bromide.

ANOMALIES.

Congenital anomalies appear in various forms. The attached reproduction shows seven metatarsals, with the normal number of phalanges, and five cuneiforms. Occasionally children may be found to have absent ribs, fusion of ribs, absent fingers or toes, or supernumerary fingers or toes.

Chondrodystrophy, synonyms: Achondroplasia, osteosclerosis congenita and micromelia. This type of developmental anomaly is the result of early fusion of the epiphyses, thus arresting the longitudinal growth of the bone, but not its growth in the transverse diameter.

Osteogenesis imperfecta, synonyms: Fragillitas osseum, osteoporosis congenita, osteopsathyrosis. This condition is an inherent quality in the bone texture which renders it brittle and as a result numerous fractures of the long bones occur.

Infantile Myxedema or Cretinism.—This disease is due to a hypofunction of the thyroid gland. It is characterized by delayed appearance of the centers of ossification. Normally the centers of ossification of the carpal bones appear at about the rate of one for each year except the first year, when two usually appear. Plate XIII, shows the wrist with but two centers, though the patient is seven years old. He is a cretin, and if normal would have seven centers of ossification.

Normally the center of ossification for the patella appears during the third or fourth year of life. In the above mentioned cretin, the center had not yet appeared. Centers for the *os calcis, astragalus* and *cuboid* bones are present at birth. At the end of the first year the center for one cuneiform appears, in the third year another and in the fourth year the centers for the scaphoid and for the third cuneiform appear. In this case of the cretin, only four tarsal centers are present. (See Plate LXIII.)

RICKETS.

The most marked changes in rickets are found at the lower end of the diaphysis of the radius and ulna, where there is a cup shaped excavation which manifests itself in many forms. This excavation is often brush-like and is lined with fine cilia-like strands. As the process heals, these depressions are gradually filled in. These changes may occur near any epiphyseal line. Baetjer states that there is frequently left behind a line of slightly condensed lime salts extending across the shaft of the bone due to faulty calcification of the epiphyses. Many cases of rickets do not show these transverse lines, and they are found in cases that never had clinical rickets.

Spontaneous fractures occasionally occur in cases of rickets even where there are no changes near the epiphyses. The beading of the ribs is often hard to visualize on a plate. Several cases in which there was beading, showed very slight changes at the wrists.

The changes that take place in the wrist bones during the process of healing are interesting to observe. In a series of cases reported by Hess, the excavations at the lower ends of the radius and ulna filled in rapidly under the administration of codliver oil. Bending of the long bones and deformities may follow the fractures.

SCURVY.

Scurvy manifests itself on the radiographic plate chiefly by sub-periosteal hemorrhages. Normal periosteum, even when raised cannot be visualized on the x-ray plate. Bone deposit and calcified clot organization occur very rapidly and then cast a shadow. Sub-periosteal hemorrhage takes place most frequently in the humerus and femur. This may be due to the fact that these bones are most frequently traumatized. The zone of destruction (the trümmer zone of continental writers) found slightly above the epiphyseal line, is not characteristic of scurvy. Fractures and dislocations may occur at the epiphyseal lines.

SYPHILIS AND TUBERCULOSIS.

Syphilis manifests itself chiefly by periosteal proliferation, whereas tuberculosis of bone is accompanied by bone destruction. Bone tuberculosis most often takes place at the ends of bones, and the process may then extend into the joint without new bone formation.

Tuberculosis of the hip-joint must not be confused with Perthe's Disease, in which the head of the femur is flattened, while the joint space remains clear. There are no erosions of the head of the femur and no bone destruction as in tuberculosis. Perthe's Disease often shows a marked degree of coxa vara.

OSTEOMYELITIS.

This inflammation of the bone marrow is manifested by bone destruction as well as by new bone formation in various degrees.

Osteomyelitis or bone abscess may be present without changes on the x-ray plate. In the presence of clinical evidence of osteomyelitis, a negative x-ray report should have no weight.

FOREIGN BODIES.

If foreign bodies are of metal, they are generally readily seen on the plate. Small and thin glass and aluminum objects cannot, however, be demonstrated.

THERAPY.

Law of Bergoine and Tribondeau.—"Immature cells and cells in the active state of division are more sensitive to x-ray than are cells which have their fixed adult morphologic and physiologic characteristics."

Lymphatic tissues are susceptible to x-ray and are more readily destroyed than are other tissues. When using x-ray therapeutically in children it must always be borne in mind that the child's skin is very sensitive to the rays. It is for this reason that it is best to properly filter the rays in administering them to children.

The chief value of x-ray therapy lies in its use in the treatment of enlarged spleen, in leukemia and in shrinking enlarged tonsils.

Although it is well known that several x-ray treatments will reduce tonsils to ⅓ their original size, the last word has not been said in this method of treatment. It remains to be seen what effect the rays will have on adjacent structures. (See page 474.)

An enlarged or persistent thymus can be successfully treated by x-ray.

The x-ray treatment of ringworm is often successful due to epilation, but is not without danger. All ointments, such as Hg, As, or chrysarobin should be removed before applications of rays are made. Thick layers of metallic ointments obstruct the rays and are liable to set up a dermatitis due to secondary radiation.

The effect of the rays on the blood is to reduce the number of white blood cells, especially the lymphocytes. Radiation is contraindicated in the case of a child with a low leucocyte count.

The Roentgen-ray treatment of tuberculous cervical adenitis is often successful.

VI.

GENERAL HYGIENE OF THE INFANT.

HYGIENE OF THE MOUTH AND TEETH.

Mouth.—Care should be bestowed on the mouth and teeth. The new-born baby should receive an occasional washing of its mouth with a weak solution of boric acid and water. This should be done very carefully and gently, or the delicate floor or roof of the mouth will be denuded of its epithelium and invite infection.

Bednar directed attention to the presence of aphthæ due to traumatism. (See Bednar's Aphthæ.)

The Teeth.—When teeth are present they should be kept clean. It is especially advisable to have the teeth cleaned with a weak alkaline solution, such as bicarbonate of soda in water. Neglect of the teeth will result in caries and foul breath. A dentist should be consulted if there is the slightest evidence of decay. The necessity for healthy teeth is very apparent in infancy and childhood. A practical method of cleaning the teeth of children is to use a pinch of table salt in lukewarm water.

THE MANAGEMENT OF THE NAVEL (UMBILICUS). THE UMBILICAL CORD.[1]

If the child is in a good condition and is not blue (cyanotic), and if the pulsations of the umbilical cord have ceased, then the cord can be tied about one or two inches from the child's body. If the child is feeble we can gain by waiting for a few moments as we admit oxygenated blood through the umbilical vessels into the child's body. The point to be remembered is to tie the cord if the pulsations therein have almost ceased. This usually takes from two to five minutes.

Some authors, *e.g.*, Epstein, advise making a gauze pouch resembling a small tobacco pouch to tie the cord. This can be easily sterilized by baking in an oven about thirty or forty minutes. Care must be taken that the heat is not too great or the gauze will be burnt.

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[1] Diseases of the umbilicus—hemorrhages, etc.—are described in Part iii.

Do not Use Oil or Salves.—When salves or oils are used they exclude the air and prevent the drying of the umbilical cord, which is so desirable. In order, therefore, to admit a current of air through the gauze to the cord, *nothing greasy should be used.* The best thing to use is arrowroot or cornstarch or a talcum powder containing 1 per cent. of salicylic acid.

The following two prescriptions are recommended as drying powders:—

℞ Talcum	100 grains.
Salicylic acid	1 grain.

Mix and apply thoroughly every morning.

℞ Talcum	100 grains.
Boric acid	1 grain.

Use as above stated.

If the child's condition is normal and healthy action takes place, then the cord usually falls off in about five to ten days.

The Dangers Incident to Carelessness in Handling the Navel.—If through some accident the ligatures around the umbilical cord should slip, and blood oozes from the wound, fatal hemorrhages can result. The attention of the physician should at once be directed to this condition. This can become a very serious matter if neglected; hence it is of the utmost importance to remedy it at once. The neglect of such things, besides the improper bandaging or uncleanliness in this region, is liable to cause not only convulsions, but blood poisoning and death.

VERNIX CASEOSA.

The child at birth is covered with vernix caseosa. It is Nature's lubricant to protect the infant from the change of temperature prior to and after birth.

It is advisable to lubricate the body with olive or sweet oil. This will soften and remove the vernix caseosa. This can be continued daily until the cord has fallen off.

THE FIRST BATH.

The ease with which an infection can take place through the umbilical[1] vessels accounts for most authors advising *against the*

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[1] For disease of the umbilicus read Part iii, Chapter on Umbilicus.

first bath being given until the umbilical cord has separated from the body. After the cord has separated and there is no evidence of inflammation or suppuration in the region of the umbilicus, then the first bath may be given. This is usually about the end of the first week.

BATHING THE BABY.

The first bath consists of an oil rub. Tub baths should not be given until after the cord drops off. New-born infants are very sensitive to draughts, hence all doors and windows should be closed. Place the tub on a low stand or table, never on the floor. The temperature of the water should be between 98° and 100° F. The bath should be given at this temperature until the infant reaches the age of three months when it may be lowered to 95°. At six months it may be given at 90°.

Always use a bath thermometer. In summer the temperature of the bath can be lowered sooner than in winter. The duration of the bath should be from two to three minutes. After the bath a soft towel should be used and friction applied until the skin glows. If the skin has a pink color a good reaction has taken place. If, however, the infant is pale and the lips become cyanotic after the bath, showing a poor reaction, then bathing should be temporarily discontinued. As a rule infants with congenital heart lesions respond poorly to baths and the skin is very pale or cyanotic after a tub bath.

If the infant is normal the tub bath may be given daily. It is more advisable to give the tub bath at night to an infant that is restless and troubled with insomnia.

Tub Bath for Nervous Infant.—The warm tub bath at a temperature of 98° should be followed by a dash of cold water over the spine and chest every morning. This is the best tonic for the nervous system.

Hardening Infants.—Those susceptible to colds should be sponged with cold water or given a cold shower immediately after a tub bath. This will harden them and prevent them from taking cold. When infants suffer with repeated colds the rhinopharynx should be inspected for the presence of adenoids.

When to Stop Bathing.—It is advisable not to bathe if an infant has an eczema or a very reddened skin, and it is a good rule to follow never to bathe if an eruption of the body is present, unless such eruption is due to an irritant applied to the skin. Turpentine, mustard, and camphorated oil, when rubbed into the skin, will cause an eruption resembling scarlet fever. Under such conditions the bath may be used; when fever appears the bath may be continued, providing there is no eruptive disease like measles or scarlet fever, and then even the baths may be given if the attending physician so desires. When children have a cough or during catarrhal manifestations, it may be advisable in some instances to discontinue the bath for a day or two. Great care should be used while bathing a child suffering with vulvo-vaginitis to avoid infecting the eyes.

CLOTHING.

In New York and similar climates children should be comfortably clad. The body *should never be overheated.* The trouble usually found is that children are coddled and their bodies overheated by an excess of flannels. I have frequently had occasion to treat eruptions similar to the lichen tropicus which was produced by an *excessive amount of clothing* and consequent perspiration.

The body should be well protected in winter, and very loose, light clothes should be worn in summer. No infant should be strapped tightly, but due allowance must be made for respiration and for the normal exercise of the infant, namely, by permitting freedom of the limbs. No pressure should be permitted on any portion of the body, so that the circulation is not impeded. Displaced organs can result from very tight fitting bands.

The Feet.—The feet should always be protected. I do not approve of hardening infants by exposing their bare legs to the peculiarly changeable climate of our Atlantic coast. I have frequently found digestive disturbances which could be attributed to cold feet, likewise inflammatory rheumatism has been seen by me more often since the advent of bare knees.

The usual shoe found in the shops for the new-born infant, as well as the first walking shoe, are simply ornaments and not practical shoes. It is advisable to devote at least enough care to have the shoes made on anatomical lines.

The Abdominal Band.—The belly-band is a source of great anxiety to the mother. Its support is valuable for the umbilicus when the child is troubled with constipation or diarrhea. It is a valuable support for the abdominal muscles if the child is affected with whooping-cough. It is not necessary to wear the band as an abdominal support more than three months. Delicate infants, premature infants, or those suffering with gastrointestinal disturbances may require a supporting bandage for a much longer time.

Night Clothing.—Due allowance must be made for seasonal changes, so that light clothing should be worn in summer and a heavier set in winter. Restlessness will frequently be induced by having the body too warm.

THE NURSERY.

To develop an infant we require fresh air and sunshine. We must only compare a flower deprived of sunlight and air to one which is developed in ordinary surroundings. An infant should be given the best room in the house, with a southern exposure. The reverse is usually found to be the case; infants are put into the smallest room, as though they were in the way. The nursery should be cheerful and sunny, and have a temperature ranging between 66° and 72° F. At night, when the child is well covered, the temperature may be lowered to 60° F. without hurting the infant.

Ventilation.—This is one of the most important matters to be considered during the development of the infant. An infant should invariably be removed from the room in which it has slept, and the windows of the nursery should be opened both top and bottom. After proper ventilation the windows are closed and the infant may be brought back again. The nursery should be thoroughly ventilated at least two or three times a day.

When to take an Infant Out of Doors.—An infant one month old should be taken out into the fresh air in summer, sometimes sooner. The first few times a child is taken out of doors it should be taken into the sun, if possible, for one or two hours. On rainy days or when it snows I invariably insist on giving the infant air by throwing open the windows and dressing the child with coat and cap as though it were to be taken into the street. This can be done for half an hour in the morning and afternoon.

The Nursemaid.—The selection of a nurse is not an easy matter. That it is an important matter we can see when we consider cases of tuberculosis and syphilis that have been unquestionably transmitted by the nurse to the child. My rule is to exclude a nurse who suffers with catarrh or throat trouble. They are a constant menace to a healthy child. Specific rules should be given by the family physician to each nurse regarding the feeding, bathing, and general hygienic management. I invariably advise against nursemaids kissing children on the mouth. They should never be permitted to sleep in the same bed with the child.

J. C., 2½ years old, was brought to me suffering with balanitis and a catarrhal discharge of the meatus. The discharge was yellowish and the child was in pain during each urination. Gram stain smear showed the presence of the gonococcus. From the history I learned that a colored maid infected with gonorrhea had slept with the child. Six months after the infection took place, although the discharge had lessened the gonococcus was still evident.

I have known more than one case of urogenital discharge transmitted to a female infant in this manner. I prefer a nurse between 20 and 40 years of age, one that is quiet, mild mannered, and that does not "know everything." It is the mother's duty to consult the physician at least once a month, or oftener, regarding details of feeding, etc., and it is the *mother's place to instruct the nurse.*

Method of Heating.—An open-grate fire or a Franklin radiator affords the best means of heating. Our city apartments in New York are furnished with steam heat, and a great many have gas heating. These latter are the worst forms of heating and are responsible for more catarrhal affections of the air passages than anything else. I invariably advise the use of a kettle with steaming water to add moisture to a room in which a gas stove or steam radiator is found.

Catarrhal diseases occur more frequently because of the intense dryness of the atmosphere in modern steam heated apartments.

The air should be kept as fresh as possible; soiled diapers or soiled clothing should never be dried in the nursery. Smoking in the nursery should not be permitted, and kitchen odors should not be allowed to reach it.

Light at Night.—To insure proper repose there should be no light and no noise in the nursery. With modern conveniences, such as electricity, a small, green, glass bulb can be used when a light is necessary. A wax night candle will answer for all purposes at night if electric light cannot be used.

The Furniture.—The simpler the furniture the better. The ease with which infants and children contract measles, scarlet fever, and diphtheria shows the necessity for plain furniture and no useless overhangings. It is advisable, if possible, to have a hardwood floor which may be scrubbed thoroughly. All rugs should be aired frequently.

The Bed and Pillow.—A cradle that can be rocked should never be used for a child. Nothing worse than a feather bed can be imagined; still, I see them frequently. The best thing for an infant to sleep on is a hair mattress, and by all means a hair pillow.

PROPER TRAINING.

From earliest infancy it is advisable to train the baby. It should be given the breast, and after it is through nursing or feeding from the bottle it should be laid in the crib. If this habit is commenced early, a regular habit of resting can be formed. If, on the other hand, we permit the infant to sleep next to its mother's breast, it will get into the habit of being fondled to sleep. Bad habits will compel the mother to be a slave to her child, and wise is she who will accept the honest, well-meant advice of the physician regarding regularity in habits.

Bowels.—An infant nine months old can be put on the commode. The best time for the infant's bowels to move is after the morning bottle. Instruct the mother to place the child on the chair, and if the bowels do not move naturally, assist the same by injecting about two ounces of water to which a few spoonfuls of glycerine have been added. This will aid in directing the infant's attention to its bowels. If the mother will do this regularly every morning the infant will gradually learn to know for what purpose it is placed on the chair.

Bladder.—What is possible with the bowels can be accomplished with the bladder. If the mother or nurse will place the infant on a vessel every three or four hours, the infant will gradually learn to hold its urine until such time. The infant should be placed on the vessel immediately on awakening, be it night or day. Children invariably empty the bladder on awakening.

Hygiene of the Nervous System.—To develop an infant's brain the nervous system requires quiet but cheerful surroundings. Useless excitement is harmful. To take an infant and handle it like a toy is wrong. I have seen infants taken up from a sound sleep to display the "talent" that some one had taught them. Nothing is more harmful than to have the mother compel her infant to display various tricks during its feeding.

PHYSICAL EXERCISE.

The health of the infant and child demands exercise. When this is neglected, disease results. Broadly speaking, there are two forms of exercise—active and passive. There are limitations to active exercise. In acute febrile conditions, rest is demanded, and all active exercise contraindicated. At such times, if necessary, massage may take the place of active exercise. Not only in acute inflammatory conditions, but also in eruptive diseases, no form of active exercise should be allowed. Recognizing the fact that violent exercise results in albuminuria, it is very important for the physician to prescribe exercise and at the same time supervise its effects on the kidneys by examination of the urine. It is important to bear in mind that in chronic kidney disease, as in acute congestion of the kidney, or following scarlet fever or typhoid fever, the resulting strain from violent exercise may do harm.

What has been said concerning the kidney applies even more strongly to the heart. After an attack of scarlet fever or diphtheria, or even after pneumonia or influenza, the effect of the toxin may weaken the myocardium. Exercise should therefore be prescribed very carefully, and the immediate effect on the heart noted. The effect on the blood-pressure, on the lungs, and on the body should be watched, so that no strain is permitted.

If dyspnea, fatigue or irregular heart action follows a mild form of exercise, then rest—not activity—is demanded, and here again passive motions aided by massage will be indicated.

It is a well-established fact in physiology that an unused organ does not develop properly; that a period of long disuse leads to atrophy; that regular exercise of an organ leads to its normal development and growth, and that organs that are exercised a great deal are, in most cases, hypertrophied. These structural changes are associated with the anabolic effects of exercise, and are most apparent in the nervous and muscular tissues, in the heart, and in the tendons, ligaments, connective-tissue sheaths, bones, and joints associated with the voluntary musculature. It seems to be true also that, in certain tissues at least, exercise not only increases the size of the individual element (muscle fiber for instance), but also increases the number of the tissue elements present, so that there are more muscle fibers in the regularly exercised muscle and more nerve cells in the regularly exercised motor center than in those muscles and centers that are not regularly exercised.

Associated with its beneficial influence upon general metabolism, physical exercise causes a general increase in the functional efficiency of the organ. The heart develops a greater strength, regularity, and endurance. Circulatory activities are improved. The depth of inspiration is increased. The rhythm of respiration is slowed. The strength, endurance, and co-ordination of the neuromuscular elements controlling the movements of respiration are improved. The necessary and very intimate co-ordination between the complex respiratory machine, the complex circulatory machine, and the complex vasomotor machine is brought into more perfect adjustment and efficiency. The heat regulation of the body is improved. Digestion, metabolism, and excretion are improved.

The production of active or potential immunity is a function of some of the fixed and circulating cells of the body. When pathogenic organisms within certain limits of virulence gain access to the tissues they are destroyed or rendered innocuous by one or more of several processes. On the cells of the body depends the exhibition of the phenomena of immunity. The degree of immunity produced is related directly to the health of the cell. An impoverished, poorly nourished, unhealthy cell will not react to the same extent and with the same success as will the normal, healthy, well-nourished cell.

The health, and, therefore, the immunity-producing power, of the cell depends upon its nourishment, including food, water, and oxygen; upon its relief from the toxic influence of its own waste products; upon its exercise, upon its opportunities for rest and repair and upon a reasonable freedom from the direct and indirect influences of pathogenic organisms. The health, and, therefore, the immunity, of the whole body depends upon the health of all its constituent parts—on the health of its cells.

If the cells are all well nourished, active, and protected from extremes of pathogenic influences, their summated health will be the health of the individual whose body they in combination make. That such a healthy individual is possessed of a certain degree of immunity has been proven empirically and experimentally, and it is equally well established that the possession and conservation of the healthy body depend upon the observance of several simple hygienic procedures.

Exercise is demanded in health and is necessary to stimulate metabolism of the food elements, and also to aid in the assimilation of food. External exercises are voluntary and are demanded to stimulate the circulatory, the muscular, and the glandular systems.

The activity of the intestinal secretions depends upon the proper exercise of the body. Lack of exercise and the lack of peristaltic waves are best seen by the resulting constipation.

In health the variety and quantity of exercise indicated depend upon the age, sex, habits, physique, and conditions of the individual. The infant must have freedom for the kicking, squirming, grasping, and twisting movements that develop his musculature, incite and perfect his larger co-ordinations, and stimulate his whole organism to normal functional activity.

The growing child continues these absolutely essential influences through his play, games, and sports, and secures these physiological benefits more or less completely in spite of the restrictions of the home, the school, and urban life.

If the infant is bound fast, he does not grow. If the child is forced to lead an absolutely sedentary or bedridden life, he does not develop.

PART III.

Abnormalities and Diseases of the Newly Born

I.

DISEASES AND MALFORMATIONS OF THE UMBILICUS.

GRANULOMA.

A MASS of fungus or exuberant granulations is frequently found in the umbilicus. Sometimes the granuloma resembles a large red bead. It is usually seen after the cord has separated. A discharge usually oozes. These granulations bleed very easily.

Treatment.—The application of a solid stick of nitrate of silver to thoroughly destroy the granulations is usually all that is required. If these granulations persist then the same can be removed with the aid of a sharp curette by simple scraping, after which a dusting powder like aristol should be used.

DIPHTHERITIC OMPHALITIS.

The newly born baby is occasionally infected with diphtheria. If there is an omphalitis the Klebs-Löffler infection can easily be transmitted. The following case will illustrate:—

A child 4 years old suffered with diphtheria of the upper air passages, which finally spread to the larynx, necessitating intubation. This family lived in a crowded apartment. The mother gave birth to an infant five days later, and was herself infected with diphtheria of the vagina and vulva. Her new-born baby was about 6 days old when I first saw it. The umbilical cord had just sloughed away. The region of the umbilicus was highly inflamed and covered with thick pseudo-membranes. The child died on the eleventh day, of septicemia. A culture taken showed Klebs-Löffler bacilli. The physician that attended this family told me that the nurse in charge of the older child with laryngeal diphtheria also nursed the mother and the new-born baby. He believed that the infection was undoubtedly carried by the nurse.

Treatment.—Saturate a piece of sterile gauze with antitoxin and apply to the umbilicus. Remoisten every hour, applying fresh gauze three times a day. Give an intramuscular injection of 1000 antitoxin units. Give 1/20 grain of calomel twice a day for three days.

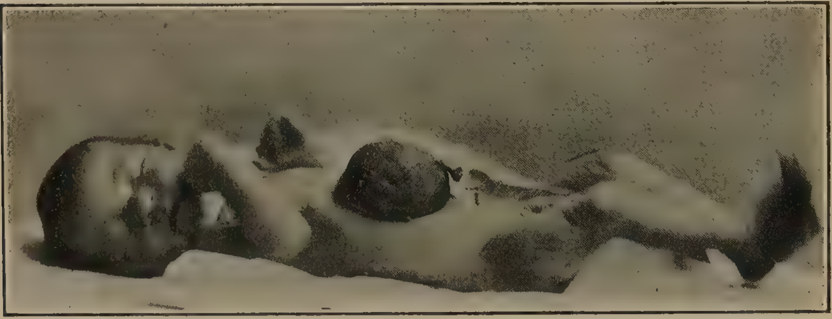

Fig. 50.—Case of omphalocele. A semi-globular tumor 4 inches in diameter, and 2½ inches above level of the body. The stump of the umbilical cord is seen on the left side of the tumor. Sterile gauze dressings were applied. After several weeks the mass gradually sloughed off and the wound closed.

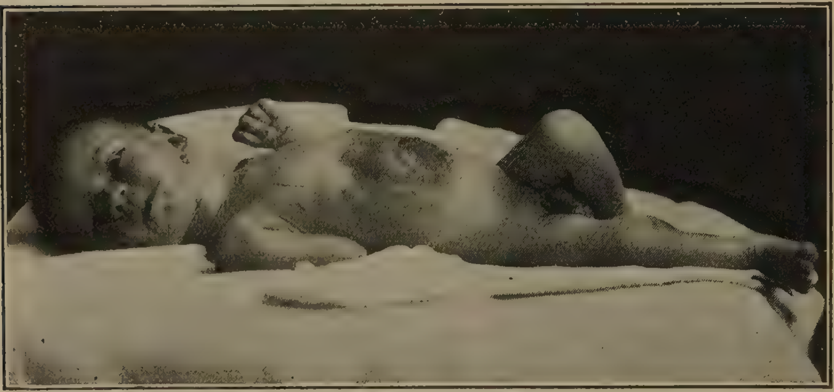

Fig. 51.—Appearance of abdomen four weeks after treatment. Case was discharged cured when six weeks old.

The local treatment should be supplemented by restorative treatment. The internal administration of 2 to 5 drops of tincture of chloride of iron, in water, three times a day, will aid in restoring blood cells, and throw off the infection. Nutrition is the most important factor in restoring normal conditions.

Egg-nogg, milk with cream, and steak juice should be used as adjuvants to the routine diet.

SEPTIC OMPHALITIS.

The following case recently came to my attention:—

It was the first child born; no previous miscarriage; family history excellent; no history of syphilis; labor was easy, and baby was born in natural manner. The mother was in excellent health; had milk in both breasts; normal temperature. Asepsis was thoroughly carried out. The infant had a temperature of 103° F., in the rectum, slight gastroenteric complication, greenish, colicky stools; the umbilicus was inflamed and excoriated; slight evidence of pus.

Diagnosis.—Septic omphalitis due, probably, to infection by the nurse with unclean hands while dressing the umbilicus.

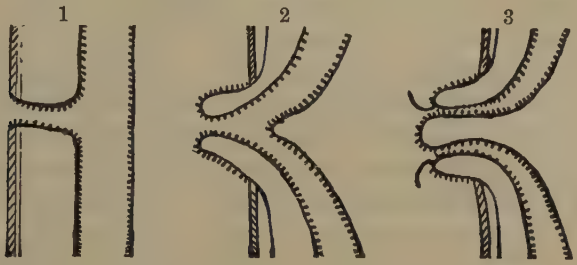

Fig. 52.—Illustrating effects of the persistence of the omphalomesenteric duct and formation of the so-called diverticulum tumor. (*Riesman.*)

1. The omphalomesenteric duct shown as an opening leading from the umbilicus to the ileum. *2.* Showing a small portion of the proximal intestinal wall. This may happen in a constipated child, while straining at stool. The same condition may occur during a paroxysm of whooping-cough. *3.* The tumor is much larger, frequently sausage-shaped. It is irreducible.

Treatment.—Strict asepsis to be followed. The umbilicus to be washed with 1 to 2000 bichloride of mercury. Sterile gauze and aristol or some drying powder applied. The stomach and bowels were cleansed with calomel, and the infant fed every two hours at its mother's breast. The child made an excellent recovery in about four or five days.

MECKEL'S DIVERTICULUM.

A condition which may at first simulate umbilical polypus, and for which umbilical polypus may be a symptom, is the persistence of a Meckel diverticulum. This consists of the persistence of a piece of intestine, usually patent, connecting the small intestine with the umbilicus. It represents a vitelline duct that failed to atrophy when the placental circulation became established, and betrays its presence by an escape of feces from the umbilicus. It is a rare malformation (Rotch).

CONGENITAL OBLITERATION OF THE BILE-DUCTS.

This condition has been carefully studied by John Thomson, of Edinburgh. He has tabulated his studies in his book on "Congenital Obliteration of the Bile-ducts," 1892.

Etiology.—There can be no doubt that various malformations of the liver and bile-ducts do occur which are certainly of this nature. For example, congenital absence of the gall-bladder has been frequently described. Some of the cases are due to arrest of development, although many are probably of inflammatory origin. Wenzel Gruber has published a case in which a forked cystic duct was found, and Konitzky has described another in which the common duct had an unusually long and curved course, and opened into the middle of the horizontal portion of the duodenum, its lumen being narrowed. O. Witzel also has published notes of an infant born with a large number of congenital abnormalities, in whom, in addition to hemicephalus, situs viscerum inversus, six fingers on each hand, etc., there was a cystic condition of the liver and complete impermeability of both the cystic and common ducts. Other developmental defects have been observed, namely, in Heschl's absence of the bile-ducts in the liver tissue, and in Simpson's want of the spigelian and quadrate lobes.

Pathology.—The liver is usually found much enlarged, of a very tough consistency—due to biliary cirrhosis—and of a dark green color, owing to the presence of numerous masses of inspissated bile in the small bile-ducts. In the great majority of cases there is complete obliteration of some part or parts of the hepatic, common or cystic ducts, or of the gall-bladder, while with very few exceptions, implication of the blood-vessels or other tubes in the neighborhood is conspicuous by its absence.

Pathology of the Lesion of the Ducts.—The lesion has been ascribed to three different morbid processes, either acting separately or in combination, namely:—

1. *Peritonitis and its results,* acting on the ducts from outside, and either compressing them or being a source of inflammatory action, which spreads afterward to their walls.

2. *An inflammatory or other lesion of the ducts themselves.*
3. *An arrest or defect of development.*

And further, various predisposing causes have been described as accounting for these morbid processes, namely:—

1. *Congenital syphilis.*
2. *Digestive disturbance on the part of the parents.*
3. *Injuries or exposure to cold,* either of the mother or child.
4. *Erysipelas* of the child.

Symptoms.—Such children are jaundiced at birth or they become so within the first week or two of life; otherwise they are healthy and well-nourished. In some cases there is meconium followed by colorless motions; in others the feces are devoid of color from the very first. The urine is deeply bile-stained. The jaundice is of a dark greenish tinge, and lasts till death, and the motions remain colorless. A certain proportion of the children die from umbilical hemorrhage within the first fortnight, and, of those who survive this period, a large number suffer from spontaneous hemorrhage from other situations. The liver steadily enlarges, and the spleen also. After living some months the children become more or less emaciated. Spasms often supervene, and death ensues in the end in a state of exhaustion from some trifling intercurrent disease.

II.

HEMORRHAGIC DISEASES OF THE NEWLY BORN.

SPONTANEOUS HEMORRHAGE.

THE occurrence of spontaneous hemorrhages is one of the most characteristic clinical features in these cases. In the cases collected by Thomson, in 21 out of the 50—that is, in almost half of the cases which lived more than a few days—the fact of hemorrhages having occurred from some part of the body is noted, and in all probability it may have occurred in some of the others also, although not mentioned, as the records of many of them are meager.

The situations of the hemorrhages mentioned in Thomson's collection are as follows:—

Subcutaneous	in 7 of the cases.
Subconjunctival	in 1 of the cases.
Umbilical	in 6 of the cases.
From nose	in 2 of the cases.
Vomited	in 4 of the cases.
From bowel	in 8 of the cases.
From mouth	in 1 of the cases.
From lung	in 1 of the cases.
Into gall-bladder	in 1 of the cases.
From leech-bite (excessive)	in 1 of the cases.

A tendency to bleed is found in many children. In the preceding chapter I have described hemorrhage as a symptom of congenital obliteration of the bile-ducts.[1] I have also described a very serious hemorrhage in a case of congenital syphilis (see chapter on Syphilis) which ended fatally. Direct infection through the umbilical vessels is a frequent cause of pyemia, and this same can result in hemorrhage.

Etiology.—Ritter studied 190 cases. Of these, 24 were associated with sepsis. Kilham and Mercelis described hemorrhages in 10 cases out of 54. It seemed that these were all due to one and the same pyogenic infection.

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[1] Read article on Congenital Obliteration of the Bile-duct, page 194.

Gaertner describes a short bacillus resembling the colon bacillus which he isolated from two cases. When the same was injected into the peritoneum of animals, a disease was produced accompanied by hemorrhage similar to that seen in the newly born. Holt describes a case from which a bacillus resembling that described by Gaertner was isolated. The absence of a sufficient quantity of calcium in the blood was supposed to be the prime cause of hemorrhage. This has been disproven by the work of Addis.[1] Sahli and more recently Morawitz and Lossen have shown that the disease hemophilia may be due to deficiency of thrombokinase.

Pathology.—Small or large extravasations of blood may be found upon the various internal organs affected. The brain, the thymus gland, the stomach, the bowels, the pericardium, the pleura, and peritoneum may have ecchymoses upon their surfaces. A frequent source of hemorrhage is the presence of ulcers. Gastric and intestinal ulcers are by no means rare.

Symptoms.—The first symptom noticed is the presence of blood. This may be present in the vomitus, in the stool, or in the urine. There may be an oozing beneath the skin or from the umbilicus. The bleeding does not amount to a very large quantity. The infant is usually very anemic. The pulse is small and feeble. The body is emaciated. The temperature fluctuates; as a rule, it is subnormal, although it may be very high. The course of the disease is short; the bleeding usually ceases in a few days.

UMBILICAL HEMORRHAGE.

Improper tying of the ligature around the umbilical cord or traumatism frequently causes a slight oozing. These oozings are very easily controlled by the application of a proper-fitting ligature. When, however, a spontaneous hemorrhage occurs it may be impossible to arrest the same with ordinary means. In these cases the hemorrhage occurs without previous warning. As a rule, the umbilicus has been perfectly normal for a few days prior to this hemorrhage. Some authors state that this condition may be fatal in less than twenty-four hours.

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[1] Quarterly Jour. of Medicine, Jan., 1909.

HEMOGLOBINURIA NEONATORUM (WINCKEL'S DISEASE).

Considerable has been written upon this obscure condition, which is very rarely met with in the newly born baby. As a rule, this condition is seen as an epidemic in a maternity hospital. Winckel reports 19 deaths out of 23 cases.

Pathology.—Hemorrhages are found in various organs. The lungs are black. The bladder, the spinal canal, the liver, and the spleen all show darkened secretions. The kidneys are dark colored. All observers state that the umbilical vessels are not involved.

Symptoms.—The skin of the body has a peculiar icteric or bronzed appearance. The palms of the hands and soles of the feet have a bluish or purplish color. The conjunctiva has an icteric appearance. The stool is blackish or greenish. The urine is dark and contains blood; it is thick and sometimes resembles syrup. There is no fever. The pulse is very rapid. Convulsions and squinting are usually seen. There is a rapid diminution in the blood cells, from 5,700,000 one day to 3,400,000 on the third day.

These cases end fatally, as a rule.

ACUTE FATTY DEGENERATION OF THE NEWLY BORN (BUHL'S DISEASE).

When an infant is born in an asphyxiated condition and there is associated umbilical hemorrhage, then an infection of pathogenic bacteria may take place. In some respects this disease resembles Winckel's disease. In both we have hemorrhages as well as fatty degeneration of the internal organs. The symptoms are a bleeding from the stomach and bowels, associated with jaundice. In Buhl's disease we have bleeding from the umbilicus.

GASTROINTESTINAL HEMORRHAGE (MELENA).

Dark-colored, tarry stools are the usual symptoms of melena. The black stool may also contain clots of blood. A crucial test for the presence of blood in examining the feces for the presence of blood-corpuscles is the microscope. Normally, meconium does not contain blood. Another symptom is the vomiting of dark-brown liquid; occasionally bright-red blood may be present.

Hemorrhages of the mouth and nose are generally due to syphilis, although ulcerative conditions may cause local hemorrhage. When pemphigus or furunculosis is present, hemorrhages frequently occur. Hemorrhage from the female genital organs may occur as well as from any other part of the body. They are usually associated with catarrhal inflammation of those parts.

Diagnosis.—This is usually very easy, especially if the bleeding is superficial. The diagnosis is difficult when an obscure place like the intestine is the source of the hemorrhage. The microscope will usually aid in establishing a diagnosis of blood in the excreta. When the bleeding is confined to the mouth and nose, syphilis should be suspected.

Prognosis.—A careful prognosis should always be given, although the disease is not necessarily fatal. Townsend studied 709 cases and recorded a mortality of 79 per cent.

The following case was seen in consultation:—

A male infant, 6 days old, vomited several times. The vomitus contained blood of a bright scarlet color. The stool had been yellowish, but became black and tarry. There was a slight oozing of blood from the umbilicus. When I applied some absorbent cotton to the umbilical stump, bright scarlet blood was seen. The infant was well nourished and was nursed by its mother. The diagnosis of melena neonatorum was made. The treatment consisted in the application of a solid stick of nitrate of silver to the umbilicus, and strict aseptic dressing. The hemorrhages were probably due to pyogenic infection.

Treatment.—Umbilical hemorrhage can best be controlled, as above cited, by the application of a solid stick of nitrate of silver followed by a dusting powder, such as:—

℞ Aristol,
Alum usta ....āā ʒij, or 8.0
Sig.: Dust over umbilicus.

Thromboplastin[1] has been recently used by me to control intestinal hemorrhage. Twenty cubic centimeters of this liquid should be diluted with 8 ounces of water. Excellent results were obtained in a child seven years old who received, by mouth, a tablespoonful of this dilution, every half-hour. Twelve doses in all were given.

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[1] This preparation can be procured from the Research Laboratory of the New York City Health Department.

For the control of intestinal hemorrhage astringent injections are not to be relied upon. The suprarenal extract is a very good hemostatic.[1] I have frequently used very small doses of hydrastine hydrochlorate, $\frac{1}{50}$ to $\frac{1}{100}$ grain, three times a day.

The injection of 15 cubic centimeters to 30 cubic centimeters of sterile horse serum is an excellent hemostatic. In the case of a "bleeder" recently seen by me, one injection of horse serum controlled the hemorrhage, due to a paracentesis, after all local means failed.

If bleeding continues in spite of the injection of horse serum, an injection of 15 to 30 cubic centimeters of human blood serum may be tried. If the latter fails we should resort to transfusion. Transfusion has been recommended by Lambert in hemorrhage of the new-born.

MENINGEAL HEMORRHAGE OF THE NEWLY BORN.

This is by no means a rare condition. It is stated that more than one-third of all still births show this to be the etiological factor. Little has described muscle spasticity and idiocy following cerebral hemorrhage and regarded this condition as due to long and protracted labors. Many of these infants die before birth, others live but a few days.

The hemorrhage is usually located on the brain itself or in the ventricles, in the arachnoid or at the base. As the meninges are usually the source of the bleeding these cases are called meningeal hemorrhages.

The pressing against and over one another of the cranial bones with the laceration of the delicate blood vessels of the meninges is a probable reason for the hemorrhage. The delicate veins which course over the convexity to the longitudinal sinus are easily torn as the parietal bones are pressed over one another.

Symptoms.—The pulse is strong, full, and usually slow. The skin has a peculiar white color (arterial constriction) and a deathly pallor due to loss of blood.

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[1] Suprarennin or adrenaline, 1:1000 may be given in 5- to 10- drop doses hypodermically.

The respiration shows a change—superficial and rapid. Reflexes are increased. The most prominent symptoms are stupor, convulsions, bulging fontanel and wide gaping sutures. Tonic and clonic contractions of the muscles of the face and extremities, followed by paresis are usually seen.

Treatment.—Lumbar puncture and the removal of 15 to 25 cubic centimeters of spinal fluid is an ideal and almost specific treatment. One puncture is usually sufficient to relieve the convulsions.

Brady, of St. Louis, is a strong advocate of lumbar puncture. Green, of Boston, likewise reports a case of intracranial hemorrhage completely cured by lumbar puncture. Cushing reported nine cases of intracranial hemorrhage with a cure of four, the result of craniotomy.

III.

INJURIES OF THE NEWLY BORN.

FRACTURES.

TRAUMATISM during labor is the cause of most fractures in the new-born baby. A predisposition may exist, due to defective ossification. When the skeleton is not properly developed, then a separation of the epiphyses of the long bones rather than an actual solution of continuity of the diapheses occurs (Ballantyne).

This author also doubts the osteomalacic nature of fractures. Antenatal fragility seems to exist by direct heredity. Griffith reports seventeen fractures occurring in one case[1] during the first two years of an infant's life. Thus we can see that there must be some other factor at work permitting recurring fractures, rather than invariably traumatism.

Syphilis is frequently a cause for a weak-boned skeleton.

Brittle bones can often be attributed to rickets. Prenatal disease on the part of the infant or its mother is frequently the cause of the fracture. Linck describes a case of an infant that was born in little more than one pain. In this case there were found over thirty fractures in the limbs and ribs.

Most of the fractures seen are of the "green-stick" variety. The prognosis in these cases is usually good, unless some complication appears.

The following case illustrates:—

An infant 2 days old had a fracture of the humerus. The seat of the fracture was in the center of the bone, and not near the epiphysis.

Mother's History.—The mother of the infant suffered with diabetes for the previous eight years, having between 4 and 4.5 per cent. of sugar. During the latter months of pregnancy she was in a subnormal condition. The labor was dry, and quite some skill was required to deliver the infant. The mother had no breast-milk, so artificial feeding was resorted to.

As this was in midsummer the infant soon became dyspeptic and later developed entero-colitis. At the seat of the fracture callus could be felt several days after I first saw this infant. Death resulted from summer complaint.

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[1] GRIFFITH: American Journal of the Medical Sciences, Chap. cxiii. p. 426, 1897.

OBSTETRICAL PARALYSIS (ERB'S PARALYSIS OR BIRTH PALSY).

This condition may be seen soon after birth, or it may not be noticed for several days after that event. It is a peripheral paralysis and usually involves the deltoid, biceps, brachialis anticus, supraspinatus, infraspinatus, and supinator longus muscles. It may also involve the extensor muscles of the wrist.

Etiology.—Erb demonstrated the fact that it is possible by a careful examination to find a spot two centimeters above the clavicle, back of the outer edge of the sternomastoid muscle, corresponding to the point of emergence of the sixth cervical nerve between the scaleni, at which point irritation by the faradic current will produce a contraction in the deltoid, biceps, brachialis anticus, and supinator longus muscles; and if the irritation be increased, the extensors of the wrist will also contract. Pressure upon this particular region is often made during delivery, either by the clavicle or by forceps, or by the fingers of the obstetrician. This is more common when there is a breech presentation and the after-coming head is extracted in the common method. The index and middle fingers of the left hand being open like a fork over the shoulders of the child, traction is commonly made upon the shoulders, and the pressure of the obstetrician's finger in the neck often produces injury of the plexus. In some cases injury of the plexus is produced by attempting to bring down the hand or arm in breech presentations, or to replace these when the head presents. Forceps applications in an awkward position may also produce this injury.

Symptoms.—The arm hangs limp at the side of the body. The position is governed by gravitation. The forearm is extended and pronated, and the wrist and fingers flexed. Movement does not cause pain. The reaction of degeneration can be demonstrated when the paralyzed muscles are examined with the electric current. Such examinations are very difficult in infants having a thick layer of fat. At times very powerful currents are necessary, thus provoking pain. In making an electrical test, the normal arm should always be compared with the affected arm.

Prognosis.—This depends on the time when the treatment is commenced. As a rule paralysis of the upper-arm type remains three or four years. In a case of mine seen recently the paralysis remained until the child was 5 years old. When the faradic current is applied and the muscles respond, then the prognosis is good; if there is no response, a cautious prognosis should be given.

Treatment.—The arm should be supported with a sling. Massage aided by a faradic current is sometimes beneficial. In severe cases it is better to use the galvanic current, using the mildest current that will produce contraction of the muscles. If the child is old enough to be instructed, gymnastics should be tried at home daily. Strychnine may be given three times a day.

IV.

ASPHYXIA NEONATORUM (APPARENT DEATH OF THE NEWLY BORN).

THE center and regulator of the respiratory movements is located in the medulla oblongata. From it also is sent the motor impulse which gives rise to the first act of respiration.

The activity of this center is believed to be augmented by the condition of the venosity of the blood; therefore, all interruptions to placental respiration—for instance the premature detachment of that organ or the compression of the cord—and all obstacles to the introducion of air into the trachea, such as mucus or blood, will be attended with violent motor impulses: first, efforts to breathe, and later, convulsive movements producing death (Boisliniere).

There are two forms of this condition usually observed; first, the apoplectic form called by older writers *livida,* and second, the anemic form called by older writers *pallida.* In the apoplectic form there is a bluish discoloration of the skin, a prominence and injection of the conjunctivæ, and a swollen state of the face and lips. The cardiac pulsations are generally strong, and the cord is distended with blood. In the anemic form the child has a deadly pallor; the lips and fingers are pale, the body limp, and muscles relaxed. The heart's action is inaudible, presenting the condition known as asystole. Duvergie, in studying the asphyxia of adults, noted that when people were removed *shortly after* an embankment of earth had buried them, they presented a turgescence of the face, a violet hue of the skin, and frequent and regular pulsations of the heart.

When they were found *some time after* an embankment of earth had buried them, they presented a deathly pallor of the skin, and the heart sounds were usually inaudible or very feeble. Thus it is apparent that the above conditions of asphyxia present, first, a *mild;* and then a *severe* type.

CAUSES.

The main causes of asphyxia are due to:—

1. Compression of the cord in a natural way.

2. Premature detachment of the placenta.

3. Forced rotation of the head in difficult forceps application or great contraction of the uterus in head-last cases, thus rendering the vessels of the uterus impermeable to blood and suspending the placental respiration. Another cause of asphyxia is shortness of the cord from its encircling the neck tightly after the head is born. The child's face in this condition becomes turgid and blue, and unless relieved the child will die. The promptest treatment consists in cutting the cord above the child's head and delivering the infant's body as quickly as possible. Boisliniere advises the above method even at the risk of fracturing a humerus.

SIGN FOR DISTINGUISHING THE STILLBORN FROM THE DEAD.

Bedford Brown[1] says that the best means for distinguishing the stillborn from the dead is to be found in the temperature. If the temperature keeps near the normal, we must not cease our efforts at resuscitation, even if the complete suspension of cardiac and respiratory action has lasted for twenty minutes or more; but if the temperature of the child suddenly falls 10, 15, or 20 degrees below the normal, then the case is hopeless. Another sign is the state of the pupil: In the dead the pupil is widely dilated, in the stillborn it is but little, if at all relaxed. The method consists in injecting into each arm 5 drops of whiskey with 1 drop of tincture of belladonna. If the infant is only stillborn, the nervous and circulatory systems respond quickly. If there is no response or only a very feeble one, warm sterilized water is injected under the skin (a dram or two) and also about two drams of aromatic spirits of ammonia. After this, dry heat is applied. If these measures fail to produce a reaction, it is a fair test of the absence of vitality.

Treatment.—If the child presents a livid condition and is apparently apoplectic with the cord pulsating strongly, *then cut the cord* as soon as possible and allow at least an ounce of blood to escape. Sometimes it is necessary to cut the cord in several places. If bleeding does not ensue rapidly, then the cord should be severed and placed in warm water at a temperature of 105° to 110° F. This will usually stimulate the flow of blood.

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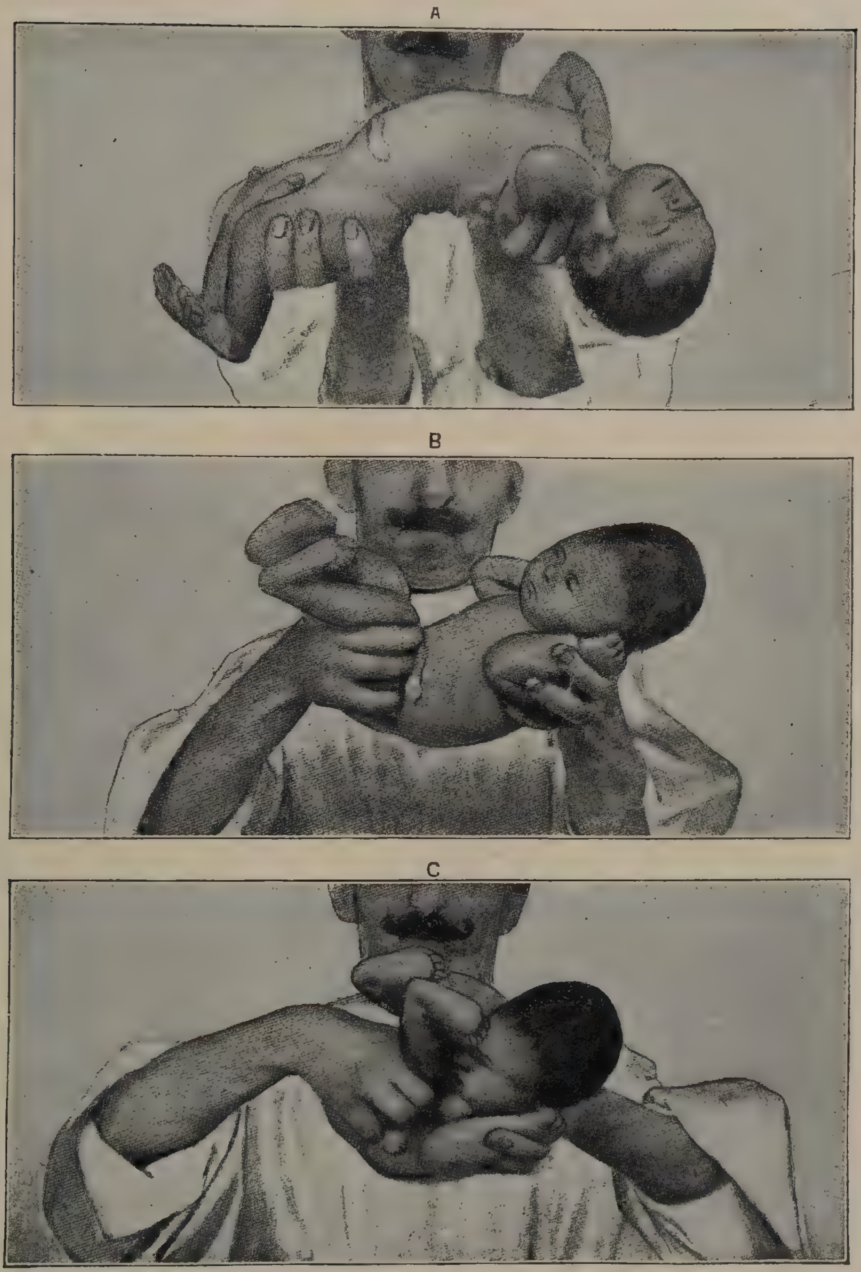
[1] Therap. Gaz., Vol. xxxi, No. 6.

PLATE XIV



The Byrd-Dew method of artificial respiration. *A*, Extension. *B*, Semiflexion. *C*, Complete flexion. (*Grandin* and *Jarman.*)

When the child is born in a pallid condition and *feels cold, then the cord should not be cut* until all pulsations therein have ceased. It is in this condition that it will be so important to rapidly cleanse the mouth, nose, and larynx of mucus and blood. Some authors advise mouth-to-mouth suction or suction made through a soft rubber catheter placed in the larynx, but these are usually preliminary means, and success will only follow methodical application of artificial respiration.

Byrd's method is very simple. It can be conducted without rough handling, a matter of vital importance. The child's body rests on its back and is supported on the palm surfaces of the physician's hands. The physician, by elevating and lowering his hands, can produce inspiration and expiration in a rapid and efficient manner. This method is well worth trying. An important point to remember is to pull the tongue forward; for this purpose an artery clamp will serve in an emergency, if the physician does not have Laborde's forceps for traction on the tongue.

Laborde advises rhythmical traction upon the tongue eight or ten times a minute. This is a valuable method and can be used while the child is immersed in hot water. Thus, the benefit of the stimulus on the tongue will be apparent while the hot bath is used.

Hypodermics of strychnine, 1/100 grain, combined with 5 or 10 minims of whiskey, may be indicated. Flushing the colon with a pint or more of water, temperature 110° to 115° F., to which a half-dram of alcohol has been added, may also aid in stimulating the circulatory and the respiratory tract. It is advisable to persevere for some time with the above method of resuscitation, even though we may be successful in our first efforts. It frequently happens that new-born infants will respond to active treatment and show signs of life, but we must continue for some time, or the respirations will cease and the infant may die.

A valuable means of restoring suspended animation consists in immersing the new-born infant, first, into very warm water, and then into cold water. Alternate from hot to cold water every ten or fifteen seconds.

INFLATION OF THE LUNGS.

This method is sometimes useful when other means fail. Some authors advise the mouth-to-mouth method. This consists in filling the cheeks with fresh air and then blowing the same into the infant's mouth. It can also be done by introducing a catheter into the infant's larynx. While the mouth-to-mouth method is simpler, it is not always a sure way of inflating the lungs. Quite frequently the air will be blown from the mouth, through the pharynx, into the stomach. To avoid the latter, the head should be thrown backward, and compression made over the epigastrium. If the nose is closed, air is less likely to enter the stomach.

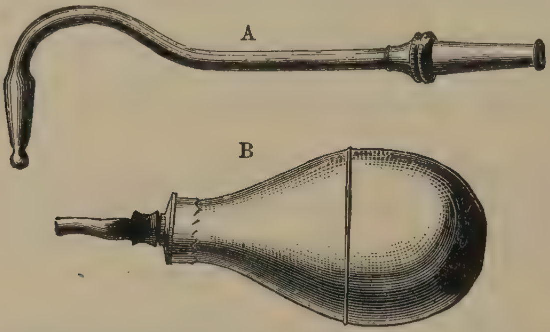


Fig. 53.—Ribemont's tube for inflating the lungs.

Mouth-to-mouth insufflation of air is not devoid of danger. Reich reported a case of tuberculous meningitis due to attempts at reanimation by a tuberculous midwife. The Ribemont laryngeal tube is much safer.

Ribemont's tube for inflating the lungs is inserted like an intubation tube. It serves two purposes:—

1. Forcing air into the lungs.
2. The aspiration of mucus from the trachea or bronchi.

Great care should be used with any and all methods. No force is necessary.

Literature records many successful cases of resuscitation of the asphyxiated child with the aid of the Draeger pulmotor.[1]

The infant pulmotor weighs twenty pounds and is carried in a box about 19 inches by 10 by 5. It contains a cylinder of oxygen. Each cylinder contains oxygen sufficient for the continuous working of the apparatus for one hour (Fig. 54).

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[1] H. D. Fry: Surgery, Gynecology, and Obstetrics, Oct., 1913.

Two flexible metal tubes connect the instrument with the mask: One forces the oxygen into the lungs under the required pressure; the other is for suction, and removes the vitiated air from the organ.

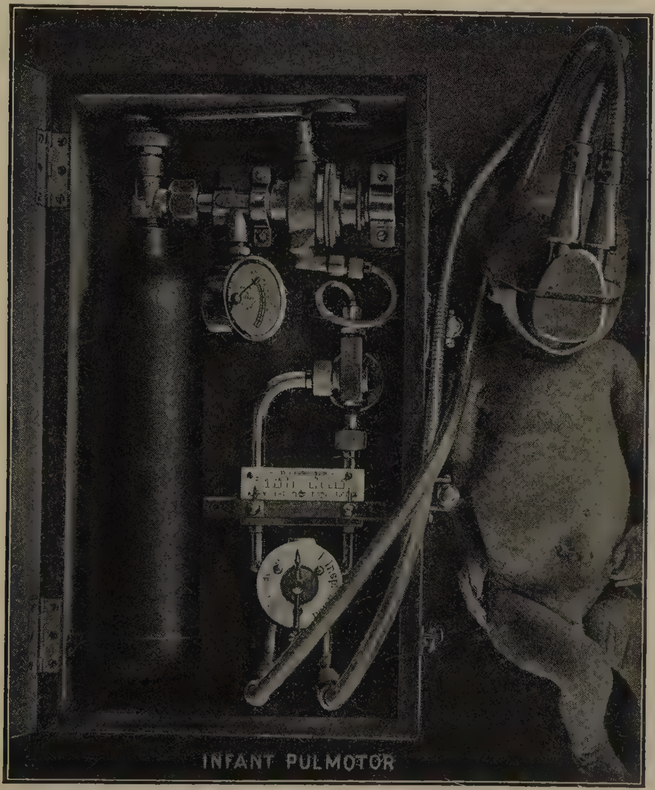

Fig. 54.—Infant pulmotor.

Technic.—The mouth, throat, and upper air passages are freed of mucus by gauze wrapped round the finger and by holding the infant head downward. It is then placed in the dorsal position upon a table or hard surface, shoulders raised and head extended. The tongue is pulled well out with a silk thread passed through the tip. This is preferable to the forceps or tenaculum, as it does not interfere with the close application of the mask. The mask is tightly applied to the face, covering the mouth and nose, and held firmly by an assistant or by a rubber band encircling the head. The trachea is pressed gently against the spine so as to close the esophagus, and if this is not enough to prevent distention of the stomach a small gauze sponge, attached to a string, can be placed in the esophagus below the larynx. Inspiratory and expiratory movements are induced by moving the lever alternately from side to side, filling the lungs and expanding the chest walls, holding the inflation for a few moments, and then deflating the lungs. If the infant should make any voluntary effort to breathe, the manipulation of the apparatus should be so timed as to inflate during the inspiratory efforts and deflate during the expiratory. Efforts to resuscitate the infant should not be abandoned as long as there is any heart action.

V.

FETAL ICHTHYOSIS.

This condition is described by Ballantyne, Kyber, Wassmuth, and Carbone as a skin disease of the fetus most probably developed about the fourth month of intrauterine life. It consists of horny epidermic plates over the whole surface of the body, separated from each other by fissures and furrows, associated with certain deformities of the mouth, nose, eyes, ears, and extremities, and leading to the death of the infant very soon after birth.

It is a rare condition, as less than 50 cases have been reported in literature. The following illustrates this condition:—

Clinical History.—This case was first seen five hours after birth. The child had passed urine and meconium, cried continuously, sleep was impossible. The slightest jar of the crib or exposure to the air increased the crying. The respiration was irregular, the surface of the body cold. The child swallowed with difficulty and was fed with the aid of a medicine dropper. The child died suddenly twenty-four hours after birth. The temperature taken soon after birth was 103° F.

Description of the Child.—There was no resemblance between the child and a human being or any living thing. The tongue was the only part of the body that seemed capable of motion. The body presented the appearance of having been in an integument much too small for the skeleton, and Nature in its growth had so stretched the skin that it had the appearance of being torn in some places. Where it was torn through, a purple-covered slit appeared; where torn partly through, a yellowish-colored fissure remained. There was no uniformity of arrangement of the fissures. Fewer were found on the back, and those on the extremities were more shallow. The color of the fissure, a purplish red, was in marked contrast to the color of the skin. In a few places bright blood was found, as if the break were of recent origin. The whole body was cold and rigid. The scalp was divided into fissures and numerous irregular conical projections, varying in size. A few thin hairs were found on the lateral surface of the scalp. The external ears were replaced by conical projections. The palpebral fissures were filled with purplish-red masses; deep down in the sockets, eyeballs could be distinguished. The nose was flattened and was identified by the widely opened nostrils. The mouth was open, showing a non-hypertrophied tongue. The lips were of a purplish-red color. The mouth measured 5 centimeters in length. Circumference of head, 36.5 centimeters; glabella to occiput, 18.5 centimeters; ear to ear, 15.5 centimeters. The neck was short. Anteriorly a fissure extended from the neck to the umbilicus, 2 centimeters in width. From this fissure, ridges of yellow skin and purple fissures extended toward the axillæ; they were of irregular size and depth.

The extremities were rigid and in the fetal position. The arms could be raised only at right angles with the body. They could not be extended at the elbow. The hands were thickened and the fingers were rudimentary. The legs were crossed. The motion at the hip and knee joint was very imperfect. The toes were rudimentary.

The median raphe in the scrotum was faintly marked; testicles were not descended. The penis was ½ centimeter in length. The anus was open. The length of the fetus was 42 centimeters, and its weight 4 pounds 13 ounces. In this case it was impossible to find any clinical cause for the disease.

Of the cause of fetal ichthyosis practically nothing is known. That it is not a fatal disease *in utero* is demonstrated by the fact that only one case thus far reported has been stillborn.

VI.

INFANTILE SPASTIC DIPLEGIA (LITTLE'S DISEASE).

In this condition we have a spastic paralysis chiefly affecting the lower extremities, so-called spastic paraplegia. Normal infants have a hypertonic condition of their extremities during the first few months. When, however, a stiffness and spasticity exists so that it is next to impossible to move the legs passively then we must suspect Little's disease. When a contraction of the thigh muscles or a severe contraction of the abductor muscles exists then a cross legged spasm will be noted. Associated with this spasticity there are exaggerated patellar reflexes. Ankle clonus is usually present. This muscular spasm usually prevents the normal sitting and standing position.

If an older child is affected, short, rapid steps are taken with the feet in tip toe position, and the knees crossing one another (spastic gait). The rigidity usually progresses and may extend to the upper extremities of the trunk.

Early in the disease the deformities temporarily disappear during sound sleep or during anesthesia.

Traumatic conditions during birth, and asphyxia are among the causes reported.

As to prognosis it is impossible to state whether or no this condition will improve. If the attack is mild the prognosis is good, if, however, the spasms persist or increase in severity then surgical means may be called for to afford relief.

VII.

INFLAMMATORY AND NON-INFLAMMATORY CONDITIONS.

ICTERUS NEONATORUM.

This form of icterus is frequently designated as a physiological condition. It usually begins on the second or third day after birth, and may continue for a week or even a month. Henoch reports a case of icterus brought to his clinic which lasted five weeks and ended fatally. The majority of text-books describe this condition as a mild disease and give a good prognosis. There are many theories as to the causes leading up to this condition. The hematogenic theory maintains that a disintegration of red corpuscles takes place. This liberates the hemoglobin, giving rise to the yellowish pigmentation.

Racchi disproved the correctness of this theory by a series of blood-counts which he reported at the International Medical Congress held at Rome.

"We can scarcely believe that the red corpuscles simply go to pieces in the blood, and that the products of such disintegration, floating freely about or temporarily lodged in the tissues, give rise to the yellow color. It is far more in accordance with the workings of the living organism to suppose that the disintegration takes place in some organ, *e.g.,* liver or spleen, and if the products thereof are floating about, it is after passing such organ and on their way to final elimination."

Schick[1] has recently published experiments lending authority to the view that icterus neonatorum is the result of hemolized maternal blood. The placenta is the place of entry of the maternal blood pigment into the body of the fetus. Schick likens the placenta to a spleen and believes that it has a spleen-like action and removes all extravasated blood and blood particles. It is in this way that the fetus often becomes filled with this extravasated blood pigment.

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[1] Schick, B.: Zeitschrift für Kinderheilkunde, Berlin, 1921.

THE NEWBORN CHILD.

A practical explanation of the frequency of jaundice in the newborn in given by Herzfeld[2]. He discusses the peculiarities of the newly born in respect to weight, temperature and jaundice.

His experiences at Riga have convinced him that if there is any period of asphyxia during the expulsion stage, so that the child swallows the mixed vaginal and amniotic fluids, jaundice most inevitably follows. Decomposition of the lochia is always noted in cases of this kind, although the woman may not show any other signs of morbidity. The vaginal bacteria are not virulent enough to affect the mother but they induce jaundice when swallowed by the infant; there is almost always slight fever with the jaundice. He treats the infant with jaundice, therefore, with systematic purging and reduces the intake of breast milk, shortening the feedings and allowing only four instead of five.

This explanation of icterus neonatorum as a "swallowing jaundice" throws light on the larger proportion of cases among the first born. It also emphasizes the necessity for clearing out the mouth at once to prevent the swallowing; omitting this, he has had jaundice develop unfailingly. He clears out the mouth by aspiration with a soft catheter, warning against the danger of injuring the mucosa when the mouth is swabbed out with cloth and finger. This does not clear it completely, even at the best. He reiterates in conclusion, that the liver is not to blame for icterus neonatorum, and that the more skilful the management of the delivery, the rarer the icterus.

Zweifel describes a series of cases of icterus resulting from the effects of chloroform passing through the placenta. The writer has noted the association of icterus neonatorum in a large number of children born after a severe labor, requiring prolonged chloroform narcosis. This may have been *accidental, yet it is worth noting.*

Voorhees, in responding to my question concerning the association of chloroform anesthesia and icterus at the Sloane Maternity Hospital, states that all women receive chloroform at said hospital, and about 33 per cent. of all infants born are jaundiced. All premature infants also are jaundiced.

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[2] HERZFELD: Jahrbuch für Kinderheilkunde, Berlin, August, 1922.

SCLEREMA NEONATORUM.

This disease is characterized by a hardening or thickening of the skin and the subcutaneous cellular tissue. The pathological lesions have been carefully studied by Northrup. His case was a foundling born amid unsanitary surroundings. When five days old the legs were swollen and the feet as hard as a board.

The swelling spread upward, involving every part of the body. The temperature in the rectum was 35° C. (95° F.). The infant died on the ninth day. The body felt as though it were frozen. Osler also describes this condition.

Symptoms.—An edema-like swelling, very cold to the touch, and very hard on palpation, involving circumscribed areas, appears soon after birth. I have seen sclerema spread from the shoulders to the trunk and arms.

The infant appears very sick. The temperature is subnormal, and recovery is rare.

I was called to see an infant 5 days old. I found the trunk swollen, the hands and feet cold, and the temperature in rectum subnormal. The infant refused the breast and had no strength. Brandy and water were prescribed. Mustard foot-bath was ordered, and 1 pint of warm saline solution injected into the colon. There was no nausea or vomiting. No retention of urine. Sclerema neonatorum was diagnosed. The swelling spread, involving the legs and arms, until the whole body, including the face, was puffed and hard. The infant could no longer open its eyes and died on the ninth day in convulsions.

MASTITIS NEONATORUM.

The new-born infant frequently secretes a fluid in the mammæ. Females, both human and animal, occasionally secrete milk without having been previously pregnant. With regard to the milk secreted by infants, there is some doubt about its real nature. Kollicker does not view it as a true milk, but considers its appearance connected with the formation of the mammary glands. This secretion is also known as witch's milk.

Sinety, on the other hand, upon anatomical grounds, considers it a true lacteal secretion. It probably is a sort of imperfect milk, loaded with leucocytes, and this is the more likely as Vollard[1] notices that it frequently ends in abscess.

Schlossberger gives an imperfect quantitative analysis of a sample of milk obtained by squeezing the breasts of a new-born infant, a male. In the course of a few days about a dram was obtained. The following was the result of the analysis:—

Water	96.75
Fat	0.82
Ash	0.05
Casein, sugar, and extractives	2.83
Sugar reaction	strong

The most complete analysis we possess of such milk is by von Gesner:—

Milk-fat	1.456
Casein	0.557
Albumin	0.490
Milk-sugar	0.956
Ash	0.826
Water	95.705
Total solids	4.295

I was called to see a female infant 6 days old. The mother told me that the breasts were swollen and contained milk. The same could be expressed by gentle stroking of the mammæ. The treatment consisted of the application of an ice-bag and inunctions of:—

℞ Ung. ext. belladonna	2 drams.
Ung. hydrarg. cin.	1 dram.
Cold cream	1 ounce.

M. Apply on linen with tight compresses.

After several days the breast dried and the swelling disappeared.

Another infant, 3 weeks old, was seen by me recently. The mother was delivered by a midwife, and her condition as well as that of the infant was apparently normal. The infant's breasts, when 7 days old, appeared tender and swollen, and the mother was advised to poultice them with flaxseed. This she did, and in addition squeezed the secretion from the infant's breasts. This traumatism caused irritation, inflammation, and finally the formation of an abscess. An incision was made, the pus evacuated, and the wound healed.

It is important to remember that the lacteal secretion in an infant's breast is a physiological condition, and if undisturbed will be absorbed gradually.

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[1] Vollard: "Traité des Maladies des Enfants Nouveau-nés," 3d ed., p. 717.

ERYSIPELAS IN THE NEWLY BORN.

When this disease occurs in the newly born, and the mother has a septic peritonitis or other infectious disease, the infant should be *immediately isolated from the mother.* The symptoms are the same as those seen in erysipelas of older children, although vomiting and symptoms of general sepsis most often accompany this condition. The fontanel is depressed.

Prognosis.—The prognosis is usually very grave, especially so if the infant must be removed from its mother's breast.

Treatment.—The strictest antisepsis must be used. An infant should be placed under the care of a trained nurse, and all instructions in regard to the hygiene of the infant must be strictly carried out. The general plan of treatment is the same as that outlined in the chapter on Erysipelas.

TUBERCULOSIS IN THE NEWLY BORN.

The transmission of tuberculosis from the mother to the newly born has not been proven. Cases are on record in which the tubercle bacilli were supposedly transmitted from the mother to the infant. Transmission of tuberculosis may take place through the placenta. The reason for the infrequency of this occurrence is that the blood of a tuberculous patient rarely contains tubercle bacilli. Schmorl and Birch-Hirschfeld believe that maternal tuberculosis can be transmitted, but not before the end of the fifth month of pregnancy, and that the placenta is always tuberculous when the fetus is infected. It is probable, however, that tuberculosis in young infants is more often the result of infection and only rarely the result of transmission through the placenta. (For further details see chapter on Tuberculosis).

PERITONITIS IN THE NEWLY BORN.

Under Septic Omphalitis I have described a case of septic infection. The case recovered. At times the inflammatory condition will extend from the umbilicus to the peritoneum, and thus a septic peritonitis results.

Bacteriology.—In such pyogenic infections the streptococcus can be found. The bacteria gain entrance directly through the umbilical vessels.

Pathology.—The same lesions affecting the serous membrane, as the pleura and the pericardium, are found in the peritoneum. Adhesions frequently remain.

The symptoms, prognosis, and treatment are described in the article on Acute Peritonitis, Part V.

PEMPHIGUS NEONATORUM.[1]

This condition is seen occasionally in the newly born infant. It consists of blebs, which contain yellow serum. In size they vary from that of a pea to that of a small bean. When these rupture they are replaced by superficial ulcers covered with a thin, black crust. Sometimes a violet stain is left, which may last for some time. The duration of each bulla is about one week. The locaticn of the eruption is on the palms of the hands and the soles of the feet. It is a streptococcus infection. The cases seen by me have invariably occurred in poorly nourished children such as we find in athrepsia (marasmus).

ERYTHEMA.

Local irritation such as might be caused by a mustard plaster or the friction of a dress, producing a "chafe" or irritating secretion such as a purulent ophthalmia or acid discharge from the nose, produces this erythema. It is frequently seen in infants on the buttocks from lack of cleanliness. When seen on the buttocks it may be mistaken for syphilis. Erythema is easily differentiated from syphilis by the absence of snuffling of the nose, of the ham-colored eruption, and of the inelastic, cracked appearance of the soles and palms.

When the skin is cracked or where a bleeding surface exists one application of a saturated solution of picric acid, followed by the dusting on of stearate of zinc, or cornstarch will benefit this condition. Oil and salves should not be applied. It is better to cleanse the parts with soap and water, then dry before applying the picric acid.

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[1] See article on Chronic Pemphigus.

VIII.

OTHER ABNORMALITIES AND CONGENITAL MALFORMATIONS.

ANGIOMA.

Circumscribed dilatations of the blood-vessels or capillaries are occasionally seen in the new-born baby. Spongy tumors consisting of tortuous blood-vessels of a bluish red color are usually seen. These tumors are filled with blood and grow very rapidly. In a case seen by me (see Fig. 55) the mass was adherent to the forehead and completely obliterated the sight of the left eye. This condition is one that can easily be rem-

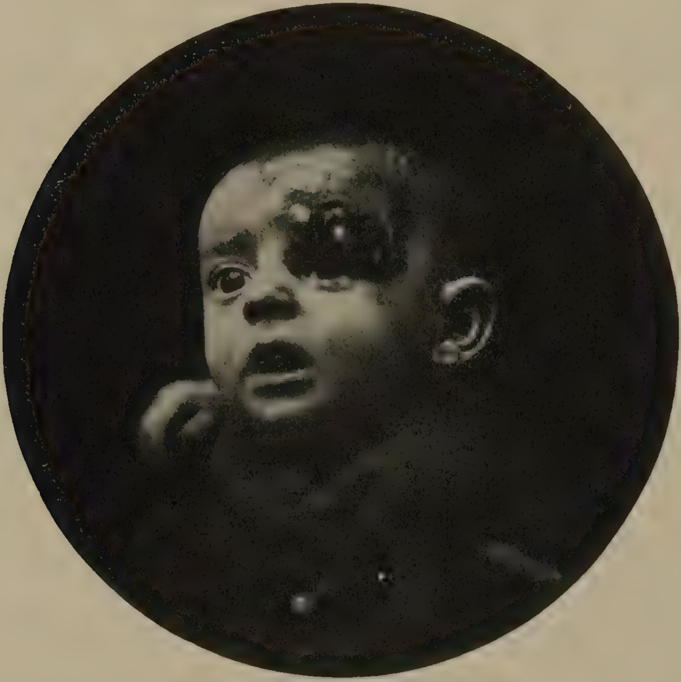

Fig. 55.—Infant 10 months old. The mass of bluish, tortuous vessels interfered with the eyesight. Bleeding was very easily provoked. Surgical treatment was the only means of eradicating this mass.

edied by prompt surgical treatment. Some cases will, if neglected, ultimately result in sarcomatous degeneration.

Treatment.—The most successful treatment of these growths in children is by destroying the same with the carbon dioxide pencil. Several applications are usually necessary at intervals of one month. The treatment is painless and does not subject the child to the shock incident to the use of galvano cautery or acids. There are no complications and with proper cleanliness infections are not seen.

If we are treating a small nevus and do not have access to a CO_2 pencil then the local application of carbolic acid followed by one drop of fuming nitric acid can be tried. Caution is necessary to use but one drop of either acid. By this means we avoid burning the adjacent tissues.

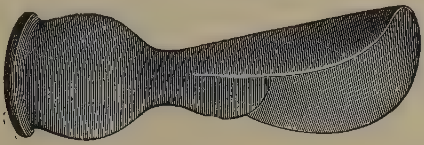

Fig. 56.—Harelip nipple.

Injection into the mass of a 5 per cent. nitrate of silver solution, or destroying the mass with a galvanocautery, chromic acid, or nitric acid, are most generally used. A good plan is to apply first pure carbolic acid, after which the fuming nitric acid should be used. This latter method is painless and effective.

HARELIP.

This congenital deformity is frequently seen in children. Sometimes it is simply a slight indentation in the lip, or the fissure may extend to the nostril. The treatment is surgical.

CLEFT PALATE.

This abnormality is frequently seen in children. While the soft palate only may be affected, it not infrequently happens that the fissure extends through the hard palate, thus causing a wide gap in the roof of the mouth.

Feeding Infants with Cleft Palate.—An infant born with cleft palate has a greater struggle for existence than a child born without this deformity. It is advisable to give the best possible food, and, therefore, breast-milk only should be used. The milk should be drawn from a woman's breast by means of a breast-pump, as described in the section on Specimen of Breast-milk for Chemical Examination.

An artificial nipple should be attached to the feeding-bottle, and to the former should be attached a flap of India rubber so made that it fits the roof of the mouth. The pressure of the nipple against the piece of rubber, when in position, converts it into an artificial palate-piece, and prevents the escape of the milk into the nose during the effort of swallowing. This shield is chosen to avoid permitting curdled milk to pass into the recesses of the turbinated bones and cause aphthous patches. (See Fig. 56.)

It is advisable to operate on an infant for this deformity after the first year of its life, if sufficient progress in its development will warrant it.

When the above method of feeding is not satisfactory and the child shows evidences of starvation, then we must resort to gavage.

Our aim should be to build up the infant from its birth, with breast-milk, if obtainable. In one case known to me the breast-milk was pumped off every four hours and the infant was nourished by gavage with this milk. When breast-milk is not obtainable, then properly modified milk should be used, to conform with the age and requirements of the child. If the child does not assimilate its food properly, the operation should be postponed until the child is built up and strong enough to stand the operation; hence the guide for estimating the time for the operation is dependent more on proper feeding than on any other factor.

Hygienic measures are very important, as the irritation by food will frequently cause inflammation in the mouth. For details of the surgical treatment the reader is referred to text-books on operative surgery.

TONGUE-TIE (ADHÆSIA LINGUÆ).

Tongue-tie consists of an abnormally short frenum. In some instances it may interfere with nursing, and possibly with speaking. It is one of the most trival disorders of infancy.

Treatment.—Incise the frenum near its attachment to the tongue with a pair of curved scissors. The incision may be enlarged with the aid of some dull instrument. Some authors advise using the finger-nail, which latter, however, is not aseptic. A tongue-tie should not be operated upon if an infection exists in the immediate surroundings.

The *after-treatment* consists in using a bland mouth wash, such as a 1 per cent. listerine solution, or 1 per cent. alum solution, especially after feeding the child.

CONGENITAL ADENOIDS.

We occasionally meet with infants in which this condition exists. This mechanical impediment prevents breathing through the nose. An infant, therefore, is at a great disadvantage, because it cannot breathe while nursing. The following case will serve to illustrate this condition:—

Mary W. had the following history: The infant was 20 days old and weighed 6 pounds and 14 ounces. At birth she weighed 7 pounds. She was nursed at the mother's breast for about one week. The infant seemed to dislike the breast, as she would draw and immediately let go of the nipple. The mother believed the infant did not like the taste of her milk. A wet-nurse was procured, and the same trouble was encountered; the infant would take one swallow and then let go of the nipple in order to get her breath. A nipple-shield was then used, but the same difficulty was encountered. The family believed that the infant did not like breast-milk, so she was given bottle feeding. She took the nipple of the bottle, drew quite well, and then let go, when it was necessary for respiration. I ordered spoon feeding, and this worked quite well. The breast-milk was pumped from the wet-nurse and fed by spoon. The child swallowed a spoonful of milk and then had a chance to breathe. An examination of the rhino-pharynx revealed adenoids. These were removed with the aid of a sharp spoon, and three days later normal conditions existed.

The infant was again put to the breast when 6 weeks old and continued to nurse successfully for six months. She was then weaned, owing to the illness of the wet-nurse. Cows' milk was substituted. Recovery was complete.

PROTRUSION OF THE EARS.

Protrusion of the ears is frequently seen in children. The anxious mother will consult the physician regarding the treatment. These cases are easily managed in very young infants. A fenestrated cap, closely fitting to the head so that the ears are well held back in their normal position, has served me very well. Young infants object to having their heads covered, but soon become accustomed to this cap, as it is only worn at night and removed in the morning. It is advisable to change the cap frequently, as some children perspire from its use. It must be worn for months before any benefit is noted.

In very severe cases in which the above treatment is not successful, it may be necessary to call in the surgeon. The operation is a simple one and the result is excellent.

ABNORMALITIES OF THE AIR PASSAGES.

When there is deficient oxygenation of the lungs, collapse frequently occurs, and is called atelectasis pulmonum. This condition is due to the unaërated condition of the vesicles. The trouble is usually found in the nasopharynx in the form of adenoids, unless some rare malignant condition is present.

Many pigeon-breasted children—with apparent rachitic manifestations of the thorax—owe this anatomical peculiarity more to improper oxygenation of the lungs than to improper feeding. In such children it is not rare to meet with congenital adenoids. (Read article on Congenital Adenoids.)

Changing the food or giving restorative treatment, such as iron or codliver oil, cannot cure such a child until the cause is eradicated.

CONGENITAL STENOSIS OF THE LARYNX.

In the chapter on Inherited Syphilis I describe a case of syphilitic stenosis of the larynx which necessitated a tracheotomy. Several years ago a child was brought to my clinic suffering with cyanosis and difficult breathing. Intubation was tried without affording any relief. As a last resort tracheotomy was performed, but this afforded no relief. A post-mortem examination showed that we were dealing with a *diverticulum of the trachea.* In addition thereto the larynx and trachea were lined with a series of syphilitic ulcerations.

PROMINENT STERNUM.

This is frequently called pigeon-breast. It is usually seen in older children. It is occasionally seen as a result of Pott's disease, but more frequently it is associated with rickets. It has been described by me in the chapter on Rachitis.

DEPRESSED STERNUM.

Congenital depression of the sternum is occasionally seen in very young infants. It is more frequently seen as a funnel-shaped depression, and is a symptom of structural weakness. It more often accompanies a general rachitic manifestation, to which I call attention in the chapter on Rachitis.

HEMATOMA OF THE STERNOMASTOID.

During labor traumatic conditions frequently induce hemorrhages. These conditions are, therefore, seen in natural labor with very large children, or when forceps are used. Pressure is cited by most authors as one of the causes of this condition. Henoch believes that hematoma of the sternomastoid is caused by twisting the head during labor. The swelling is due to an extravasation of blood and to inflammatory conditions of the muscle. It is rarely seen before the child is two or three weeks old. There is no treatment necessary. The blood is absorbed and the swelling gradually disappears.

CEPHALHEMATOMA.

A swelling is sometimes seen on the top of the head during the first few days of the infant's life. It is usually associated with the application of forceps or a similar injury during labor. This condition is rare in children. The statistics of the Sloane Maternity Hospital show that this condition was met with in 20 out of 1300 consecutive births, or 1.6 per cent. There may be several swellings. They are most frequently seen over the parietal or occipital bone.

Symptoms.—A swelling that is very soft and fluctuating is noticed. This swelling gradually increases in size, and attains its maximum at the end of twelve or fourteen days. There is no pulsation palpable. The temperature is usually normal.

Diagnosis.—This condition is frequently mistaken for encephalocele. The latter, however, is always seen in conjunction with the fontanel or along the line of the sutures.

Pressure causes cerebral symptoms. This condition can be confounded with hydrocephalus. In the latter the symmetrical enlargement of the whole head is always a characteristic feature.

Baby M., 7 days old, was born with the aid of forceps, after a very difficult and dry labor. When the infant was 3 days old a swelling was noticed on the scalp over the left parietal bone. This swelling gradually increased in size and felt soft, doughy, and fluctuating. An incision was made which liberated about 4 ounces of clear, fluid blood. The child recovered.

Treatment.—The above case illustrates the mistake that can be made. A hematoma is a benign condition and disappears without treatment. Bandaging and compression are unnecessary, but injury to the part must be avoided.

CAPUT SUCCEDANEUM (SPURIOUS CEPHALHEMATOMA: SUPPLEMENTARY HEAD).

This is a swelling of the scalp due to congestion, resulting in an extravasation of the blood and lymph into the subcutaneous tissue which is external to the pericranium. This swelling does not fluctuate. It is usually seen in that portion of the head which first presents itself at the vulva during labor. No treatment is required, as this condition usually becomes normal.

CONGENITAL CYST OF THE KIDNEY.

The literature records an occasional case of this condition. There are no symptoms which would be the means of determining this condition during life. The diagnosis is therefore made post-mortem.

CONGENITAL SACRAL LIPOMA.

J. B., male infant, 11 months old, appeared in good health. The mother noticed a large swelling over the sacral and lumbar regions. The infant did not seem to be in pain. The growth was non-inflammatory and did not interfere with the movements of the legs. The diagnosis of congenital lipoma was made and an operation advised. The tumor was removed. The case recovered.

CONGENITAL MALFORMATIONS OF THE RECTUM.

E. R. Kirby[1] states that these occur under the following types:—

1. Congenital narrowing of the anus or rectum, without complete occlusion. The anal aperture is at times preternaturally small, either in consequence of a contraction of the lower end of the rectum, or from the fact that the skin may extend occasionally over the border of the anal margin. The diagnosis is usually easy, for the contraction is near the anus and can be readily detected by the finger, or seen when due to a fold of skin extending across the anus. The treatment consists in dividing the ring or skin on the dorsum, and daily dilatation, either with the finger or soft rubber bougie.

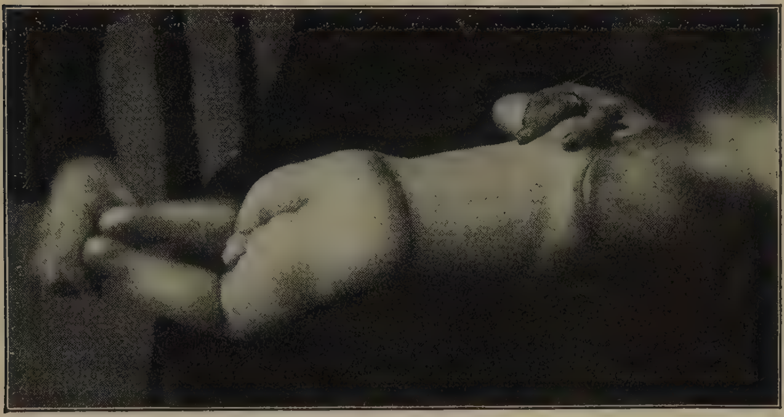

Fig. 57.—Congenital sacral lipoma.

2. Closure of the anus by a membranous diaphragm (atresia of the anus) is the simplest of all forms of congenital malformations, and is treated by a crucial incision through the membrane.

3. In imperforate rectum one may expect to find some of the most difficult cases of malformation, although some are comparatively simple. Instead of a normal anus the skin of the perineum extends across the anal region from side to side, and the rectum may terminate quite a distance from the normal site of the anus. The intervening space may be made up of con-

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[1] Kirby: "Congenital Rectal Malformations." Archives of Pediatrics.

nective tissue, while a circular elevation or depression marks the normal site of the anus. Occasionally a distinct fibrous cord may be traced from the rectal pouch to the skin. If the rectal pouch be not at too great a distance from the skin, a sense of fluctuation may be felt by firm pressure of one finger over the anus and the hand over the abdomen.

4. The system which separates the anal and rectal pouches in cases of imperforate rectum with a normal anus is generally within easy reach of the anus. It may be perforated and slow dribbling of meconium allowed. There may also be more than one septum.

5. The anus may be absent and the rectum open at any point in the perineum or sacral region. The lower portion of the rectum in these cases is usually of a fistulous character, lined by true mucous membrane, and the abnormal anus is always narrow and insufficient for its purpose. Occasionally the rectum terminates in two distinct openings, at a greater or less distance from each other.

6. The anus may be absent and the rectum terminate in the bladder, urethra, or vagina. In females the vaginal opening is the most common; in males the vesical. This condition is usually rapidly fatal unless relieved by prompt surgical interference.

7. The rectum or the large intestine may be entirely absent.

Kirby lays down the following rules:—

1. An operation should always be performed, and performed without delay.

2. If there be any chance of establishing an opening at the normal site of the anus, the surgeon should at first direct his attention to this procedure.

3. The use of a trocar as an aid in finding the rectal pouch before or after incision through the perineum is not sanctioned by modern surgical authority.

4. The results of attempts to establish an outlet for the imperforate rectum through the perineum are not favorable as regards the production of a useful anus.

5. In case of failure to establish a new anus in the anal region, colotomy should at once be performed.

6. In the formation of an artificial anus the left groin is the best site for the operation.

7. Attempts at establishing an anus in the anal region after a colotomy are attended with great danger, and are generally unsuccessful.

PART IV.

Diseases of the Mouth, Esophagus, Stomach, Intestines and Rectum, and Diseases Associated with Improper Nutrition.

I.

DISEASES OF THE MOUTH.

STOMATITIS.

An infection existing on the tonsils or in the pharynx can spread to the mouth. Food, especially milk, is sometimes the means of directly conveying infection; this is especially true when milk contains pathogenic bacteria. Syphilis and rickets undermine the system, hence we find these conditions frequently as predisposing causes. The mouth is particularly liable to local infection. The slightest traumatism by diseased teeth, *especially in acute cases,* can produce local irritation. Non-pathogenic bacteria are always present in the buccal cavity under normal conditions.

The glands of the mouth being excretory frequently produce inflammatory conditions by virtue of systemic poison excreted by them which may produce local lesions. One of the best writers on this subject is Forchheimer, whose classification I have adopted: I. Stomatitis Catarrhalis. II. Stomatitis Aphthosa. III. Stomatitis Mycosa. IV. Stomatitis Ulcerosa. V. Stomatitis Gangrenosa. VI. Stomatitis Crouposa; Stomatitis Diphtheritica. VII. Stomatitis Syphilitica.

STOMATITIS CATARRHALIS.

Simple stomatitis may be confined to a local area or it may be general. When the mucous membrane is irritated by severe rubbing, as during mouth cleaning, this condition frequently follows. Dentition does not produce stomatitis. This catarrhal form is usually one of the earliest manifestations of acute infectious diseases. Great stress is laid on this condition as a diagnostic point in measles prior to or associated with the enanthem on the buccal mucous membrane. When a small area is affected, a local cause, such as a diseased or sharp tooth, or some mechanical cause, must be looked for.

Symptoms.—The usual symptoms of pain, hyperemia, and swelling are noted. The lining of the mouth is puffed and hyperemic. The mucous membrane is covered with small, round prominences due to the swelling of the muciparous follicles. When the ducts of the latter become closed the glands dilate and there are produced cysts, the contents of which are clear, viscid mucus. We also find slight epithelial abrasions, sometimes leading to the production of a deeper process; at all events important in that they may become the seat of infection. The lymphatics are usually involved, and they serve as a guide to the intensity of the inflammation. Cases are on record where the temperature reached 104° F. in the rectum, but these are rarities.

The prognosis is invariably good. Unless some chronic disease is the seat of this trouble there are rarely any disagreeable after-effects.

Treatment.—The treatment consists in cleanliness. Remove the cause if possible. Remove mechanical irritants, such as diseased or sharp-pointed teeth. Boric acid, 1 per cent. solution, or sulphocarbolate of zinc or sulphocarbolate of soda, 1 grain to the ounce, are valuable local astringents. At times nitrate of silver (2 grains to the ounce) will act well when applied locally. Forchheimer recommends the application of silver nitrate when there is loss of epithelium. Cysts should be opened and their walls cauterized when necessary. My best results are obtained by the use of argyrol, 5 to 10 per cent. solution, applied once.

STOMATITIS APHTHOSA.

This condition is not follicular and has nothing to do with the muciparous follicles, as it is found in places where there are none.

It consists in a hyperemia of the mucous membrane of the mouth associated with superficial ulcers.

Causes.—There seems to be a decided reason for believing that this disease is of microbic origin. Aphthous ulcerations have been seen in children partaking of milk from cows that suffered with foot and mouth disease. Demme reports a case of twins fed on goat's milk, the goat having foot and mouth disease. The milk was fed fresh and raw. One of the twins, the boy, had a severe aphthous condition of the entire mouth and throat, and died after seven days of illness. The other, a girl, was also sick with aphthous sore mouth, but recovered after five days' illness.

Robinson reports a severe epidemic of aphthæ acquired from foot and mouth disease in Devonshire. Two hundred and five persons were affected in one week. Two children died, the aphthous condition having extended to the respiratory tract.

Boas has also reported cases of foot and mouth disease and their results. Bohn states that the disease is most common between the tenth and thirteenth months of life. Therefore, teething has something to do with the eruption. Siegel studied an epidemic of foot and mouth disease, resulting in aphthous stomatitis in children. An ovoid bacillus 0.5μ long was found in all cases. We can assume that foot and mouth disease in cattle is the etiologic factor of stomatitis aphthosa in the human being.

Symptoms.—White or yellowish white epithelial spots are seen singly or in groups, surrounded by an areola and developing anywhere in the mouth. In many cases they extend into the pharynx, and Forchheimer believes into the larynx. This disease is frequently associated with acute gastric catarrh, constipation, and with general toxemic conditions. The eruption may be preceded by pain in the throat, fever, enlargement of the lymphatics, and a general train of nervous symptoms so common in children.

The diagnosis, therefore, will be difficult until the eruption appears. The spots frequently are absorbed. Successive crops may come and go.

Treatment.—Local treatment such as the application of phenol glycerine thoroughly rubbed into the cheeks, gums, roof of mouth, and tongue usually suffices for a cure. If, however, the infection persists this treatment can be repeated daily until cured.

℞ Phenol	ʒss	1	5
Glycerine	℥ij	50	0

Sig.: Apply on cotton swab.

Local treatment suffices. All milk should be boiled. The nipple should also be boiled to insure sterility.

BEDNAR'S APHTHÆ (STOMATITIS ULCEROSA).

The small, yellowish-white, ulcerative patches which appear on one or both sides of the hard palate in the newly born are known as Bednar's aphthæ. They may be mistaken for the ulcers produced by the breaking down of milia or retention cysts, or for that condition described by Epstein in which there are congenital defects in the mucous membrane filled up with epithelial detritus (Forchheimer). They are usually the result of violence in cleaning the mouth. Frequently an improperly shaped nipple will cause this condition by pressing on the palate.

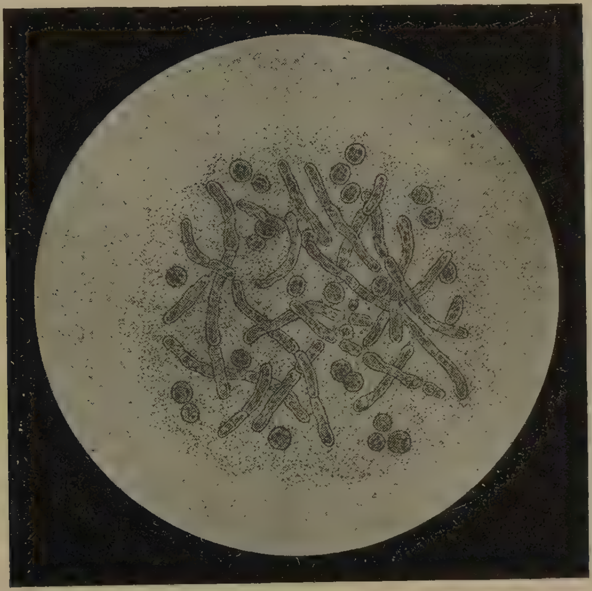

Fig. 58.—A case of sprue (thrush) due to faulty hygiene of the mouth. Note threads (mycelium) and small oval bodies (spores). (After *Jagic*, klinische mikroskopie.)

STOMATITIS MYCOSA, OR PARASITIC STOMATITIS.

This disease is commonly known as thrush, sprue, soor, or muguet. It occurs in the mouth in the form of yellowish white spots and is due to a fungus first discovered by Berg, of Stockholm, and called *oïdium albicans* by Robbin. Forchheimer states that the fungus is found in two forms, the yeast form and the globulofilimentous form (frequently called mycelium). There is no ascospore, therefore. Roux and Linoissier state that the fungus is not a saccharomyces. The chlamydospore has, however, not been satisfactorily worked out.

Propagation goes on in three ways: By filaments produced from conidia, by isolated conidia, and by spores.

Symptoms.—Local symptoms vary with the severity of this condition. At times no symptoms precede the appearance of these small spots. The spots are grayish white or creamy in color. They may be elevated above the surface of the mucous membrane. They are not confined to the gums, but appear frequently on the lips, tonsils, pharynx, and cheeks. There is a fetid breath due to the inflamed gums. Children that are old enough to complain do not describe any subjective symptoms. The lymphatic glands are always enlarged and do not suppurate. When suppuration takes place it will follow after the disease in the mouth has disappeared.

Treatment.—*Prophylactic treatment* of the mouth, consisting in the usual hygienic measures, can prevent this condition. Aseptic details must be rigidly enforced in the nursing bottles and nipples when this disease is present.

Treatment consists in the application of a 1 per cent. boric acid solution as a mouth cleanser, followed by the local application of a 3 per cent. chlorate of potassium solution. Where a specific cause exists, such as carious teeth or dead bone, the same should be removed before attempting to cure this condition.

CROUPOUS STOMATITIS, OR DIPHTHERITIC STOMATITIS.

This rare condition is occasionally met with in children. The prognosis and treatment should be considered just the same as though we were dealing with diphtheria in the throat. The following interesting case will serve as an example:—

The child was 7 months old, female, breast-fed, had always been in good health. No family history of tuberculosis, lues, rheumatism, or epilepsy. The child was vaccinated when about 6 months old, had had no previous illness excepting slight irritability about the time of the eruption of the first tooth. It had two teeth, incisors, lower jaw. General appearance not anemic or rachitic, had well nourished muscles and a fair amount of fat. Skin had a healthy appearance. Four other children in same family; three apparently healthy, the fourth was convalescing from an attack of "sore mouth." The infant had been gaining weight regularly since birth. It now weighed 15 pounds and 8 ounces.

An examination of the infant showed: Two large patches—one on the tip of the tongue; the other on the soft palate—which were irregular in outline, yellowish-green in appearance. Temperature in the rectum 100⅕° F., at 11 A.M.; pulse, 142; respiration, 39. Cervical glands considerably enlarged on both sides. No history of existing infectious disease in the same locality. The diagnosis of stomatitis ulcerosa was made and a question mark (?) entered after the same. Diphtheria was suspected. The mother was cautioned in regard to the other children, and the case carefully watched. I again saw the case two days later and found the child in a worse condition. The temperature in the rectum at 4 P.M. was 102⅕° F.; pulse, 160; small, feeble, but quite irregular. The examination of the mouth showed an extension of the inflammatory condition of the patches, now involving the uvula and left tonsil. The pharynx showed an abnormal redness, but no membrane was visible.

The mother's breast was painful on palpation. The glands were distended with milk, and the axillary glands enlarged and tender on palpation. The mother complained of aching in her limbs—a "tired feeling," as she called it—and had chills, alternating with fever. Her temperature was 99⅘° F. in the mouth. There were membranous patches around one of her nipples. This resembled a cracked nipple. While examining the infant's mouth I saw what appeared to be membrane. A similar condition was found around the nipple. I inoculated two agar-agar tubes and sent them to a laboratory. After twelve hours, small colonies of both streptococci and bacilli could be seen. On staining with Löffler's alkaline methylene blue, Klebs-Löffler bacilli were seen. A culture was made from the patch in the mouth, from the uvula, and also from the pharynx. The tube inoculated with the uvula patch and the one from the tongue contained the characteristic Klebs-Loffler bacilli. The usual method of treatment and active stimulation was given. Concentrated liquid diet (rectal feeding) was given when the infant refused the breast. An important question suggested itself: Shall we wean the infant? or, mother and infant having the same disease, could the infant be nursed on the healthy breast? It will be remembered that only one nipple was diseased. I resolved to give the infant the milk of the healthy breast and to guard against another sore nipple by nursing through a glass nipple shield. The milk in the diseased, or left, breast was drawn out with a breast pump and thrown away.

Three weeks after apparent cure of the mother's breast and also after the last visible membrane from the infant's throat disappeared, the mother complained that she slept with one eye open. On examination, I found a distinct facial paralysis on the right side. The diagnosis was strengthened by the sequel in the case. To sum up: I believe the infant, while having diphtheria, infected its mother through the fissure of the breast during the act of nursing. Considering the physiology of nursing, we know the rôle played by the tongue, and, as the disease was first manifested thereon, it can be readily seen how this might have been inoculated from tongue to the breast through its cracked nipple.

SYPHILITIC STOMATITIS.

Primary infection in syphilis is by no means rare. It usually occurs by transmission from a wet-nurse suffering with syphilis.

A case of this kind was seen by me in an infant 9 months old. This infant was accidentally infected by a woman who nursed it during the mother's illness. She had erosions (cracked nipples) and did not know that she suffered with syphilis. Her own child died of distinct syphilis, having had pemphigus and the general cachexia so common in luetic conditions. This case was given small doses of calomel, and a bichloride bath (see chapter on Syphilis) and showed signs of improvement almost immediately. In the mouth of this child the ordinary mucous patches were found.

Treatment is that of syphilis. (See chapter on Syphilis.)

NOMA (STOMATITIS GANGRENOSA; CANCRUM ORIS[1]).

This disease is frequently called noma, and sometimes cancrum oris. It is characterized by a gangrenous destructive process located on the cheek. Although the left cheek is the favorite site of the disease, it can frequently be found on both cheeks. The writer has met with children suffering from this disease on the right cheek. Girls are more liable to noma than boys. It is usually secondary to some contagious disease, and has been known to follow typhoid fever, smallpox, scarlet fever, measles, pertussis, and allied infectious disorders. We must, therefore, assume that the infectious diseases are predisposing factors in the development of this disease.

The process usually commences on the gums or the inner portion of the cheek, and spreads very rapidly to the adjacent tissues. Thus it is that it will destroy the inner portion of the cheek and spread to the outside, causing similar destruction to the healthy tissues.

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[1] Abstract from the American Journal of the Medical Sciences, April, 1902.

Bacteriology.—Perthes[1] found that noma is due to a fungus-like growth belonging to the streptothrix group. At the border line between the gangrenous ulcer and normal tissue he found a thick, branching network of fine, fusiform threads—mycelium. From this mycelium single, fine rods and spirilla extend into the normal tissue, surrounding the cells, and cause their death. Krahn believes that the growth described by Perthes consists of two organisms—the spirillum sputigenum and spirochete dentium. The majority of observers agree with Perthes and Seiffert. The same bacteriological picture was described in noma of other parts of the body by Matzenauer. Perthes prepared his specimens for examination by treating the teased tissue or section from the edge of the ulcer—removed *post mortem*—with dilute carbol-fuchsin for twenty-four hours and then briefly washing with alcohol. Weaver and Tunnicliff[2] demonstrated that this streptothrix is decolorized by Gram's method. They obtained the best staining reactions by dropping a 10 per cent. saturated solution of alcoholic gentian violet in 5 per cent. phenol on the section (that had been embedded in paraffin, treated with xylol, followed by absolute alcohol) for five minutes, clearing with aniline oil, washing with xylol, and mounting in balsam. A complete bibliography of noma is given by Weaver and Tunnicliff.[3]

Symptoms.—The cheek will appear swollen, hard, and edematous to the touch, the edema causing such swelling that frequently the eye of the affected side cannot be opened. There is a decided fetor to the breath, which is often the first symptom noticed. The disease spreads very rapidly from the gums to the cheek. Frequently the teeth will loosen and fall out. The latter is also caused by the administration of large doses of mercury. Thus it is that great care should be used in giving mercury to children.

It is not an inflammatory disease. The temperature is rarely or never above normal. The swelling can best be felt by opening the mouth and grasping the cheek between the thumb and forefinger. The skin over the induration is frequently mottled with purple spots resembling ecchymoses. The appetite is diminished, partly due to the fear of pain caused by chewing.

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[1] Perthes: Arch. für klin. Chir., 1899, lix.

[2] Weaver and Tunnicliff: Journal of Infectious Diseases, 1907.

[3] Weaver and Tunnicliff: Journal of Infectious Diseases, Jan., 1907.

Some authorities state that children so affected have diarrhea. Forchheimer believes that hemorrhages rarely occur, owing to the blood-vessels being filled with thrombi.

When this gangrenous mass discharges we will find a dirty, fetid saliva, with threads of broken-down tissue. The cervical glands in the immediate vicinity are always found enlarged. In severe cases it is not rare to have the parts ulcerate and even perforate the cheek after several days. When the disease extends inward, not only does periostitis occur, but necrosis of the jaw-bone has been noted. When the disease is as malignant as has just been described, then subnormal temperature, possibly delirium, may complicate the condition. The disease may extend to the lungs, causing a gangrenous infiltration. When the gangrene affects the genitals in girls, then a serious prognosis must be given.

The following cases will illustrate the condition described:—

Elsie G., aged 7 years, had complained of severe headache for three or four days, and was very feverish. Her mother became alarmed because of persistent vomiting. She stated that the child vomited at least six times in twenty-four hours. She complained of feeling fatigued and had pains in her arms and legs.

The child was nursed for ten months, and was a strong baby up to this time; dentition commenced at the seventh month; the child's muscles and bones were well developed; there were no evidences of rickets; the first two years were passed without any sickness except an occasional attack of constipation. The child walked at the end of the first year and commenced talking at its fourteenth month. Twenty teeth—"milk teeth"—appeared at the end of two years. The child had measles in its third year, which left a bronchitis; the mother stated that this same cough recurs every winter. The child had had whooping-cough, lasting four months, which was so violent that it had epistaxis almost every day for one month. This whooping-cough was so severe that, in addition to the nose-bleed, the child vomited almost continuously. From loss of sleep, in addition to the above-named symptoms, the child commenced to emaciate. This was at the end of her fifth year.

When the child was undressed an eruption was found all over the body, which was that of typical scarlet fever. The throat was filled with evidences of pseudomembranous patches, which were distinctly scarlatinal in character. The temperature was 103.4° F., taken in the rectum; pulse, 128; respiration, 22. The child was put to bed and an expectant plan of treatment ordered, in addition to a very light liquid diet consisting of milk, buttermilk, and broth. Nothing else was allowed; no solids were given. For the thirst I ordered orange juice and apple sauce. Small doses (wine-glasses) of citrate of magnesia were given for their laxative and diuretic effects.

The heart sounds were very feeble, and a loud, blowing, hemic murmur, which was attributed to the anemic condition, was audible. Iron was given in the form of the syrup of iodide of iron; hypophosphites were also administered as restoratives. Convalescence lasted in all until April, a period of almost three months from the time of the child's first illness. About this time she complained of pain in the gums and on the cheek while chewing. Later the foul breath attracted attention. At first this condition was attributed to the teeth, but a dentist who saw the child found the teeth and gums healthy. The ulceration, which had now become quite marked, from the size of a silver dollar, spread with remarkable rapidity. Its color was dirty, blackish gray, and purpuric spots were scattered around the edges of this ulceration, resembling subcutaneous hemorrhages. On examining it considerable fluid, which was very foul smelling, exuded on pressure. Fifty per cent. peroxide of hydrogen diluted with water, was ordered as a mouth wash. The child was told to rinse the

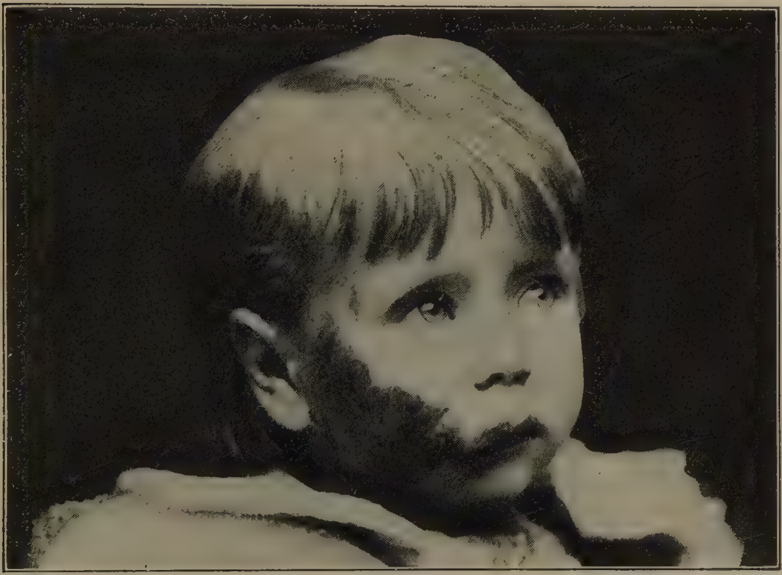


Fig. 59.—Case of stomatitis gangrenosa (noma) following scarlet fever. The picture shows the unilateral gangrenous condition involving the right cheek and the lips. Case recovered. Clinical history given in the text.

mouth every half-hour, especially after eating. The gangrene extended to the outside of the cheek, involving, as can be seen by the illustration, almost the whole cheek.

The streptothrix is usually present in the pregangrenous stage and it is here in this stage that the best therapeutic results are attained. As a rule, the disease appears in epidemic form. In diphtheria, scarlet fever, and especially measles oral hygiene must be instituted to prevent stomatitis, and especially ulcerative stomatitis. The latter is frequently a soil for the development of noma and hence every case of stomatitis should receive active treatment to prevent gangrene.

The following case was seen by me during my service at the Willard Parker Hospital:—

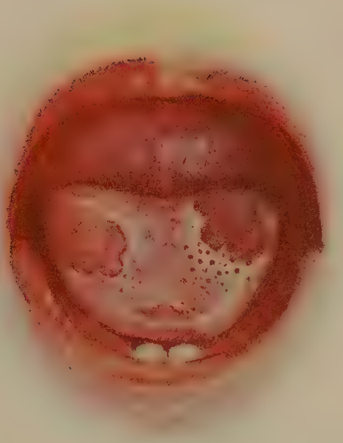
Child C., 3 years old, was admitted with a moderately severe type of scarlet fever. Later a complication of noma developed, and this was the reason for the injection of 0.2 gram neosalvarsan. Within three days after the injection a slight improvement was noted, which continued steadily until the case recovered, in all, ten days from day of first injection. The noma involved the pharynx, tonsils, and soft palate.

When fetor of the breath exists, a strong solution of permanganate of potassium as a gargle or spray every two hours will deodorize. Internally tincture of iron as a restorative should be given. The insufflation of a small quantity of neosalvarsan used locally once a day is advised. If fever exists, and toxemia complicates, an intravenous injection of 0.2 gram neosalvarsan dissolved in 40 cubic centimeters of sterile water and injected into the jugular vein has caused marked improvement in a number of my cases.

EPITHELIAL DESQUAMATION (GEOGRAPHICAL TONGUE).

This herpetic eruption is occasionally met with in children. It is a local infection caused by the invasion of a fungus which seems to eat away irregular patches somewhat resembling ringworm of the scalp. The borders of these patches are surrounded by a thickish grayish margin. The center has a glazed appearance. There are usually two or more of these red patches seen at one time. They last weeks and months. From the irregular outline resembling a map the name of geographical tongue originates.

PLATE XV



Geographical tongue, or epithelial desquamation.

I have seen these cases in children living amid unsanitary conditions as well as in those living under excellent sanitary conditions but where the hygiene of the mouth was neglected.

I have seen cases of this kind among children suffering with diphtheria at the Willard Parker Hospital, the condition, however, existed prior to, and remained long after, the attack of diphtheria.

Minnie H. Fourteen months old. Had been in delicate health since birth. Although breast-fed, had always been constipated and suffered with gastritis, and vomiting occasionally.

She was very anemic. Could neither stand, walk, nor talk. Dentition had been delayed; there was no sign of teeth. The tongue showed four large, irregular patches, and two smaller ones in the center. They appeared as though a coated tongue had irregular patches of red, and shining flesh interspersed. Diagnosis, rickets and geographical tongue. The etiological factor in this case was faulty hygiene of the mouth.

Treatment.—Ten per cent. nitrate of silver solution should be applied thoroughly and repeated in ten days if necessary. Tincture of iodine, diluted five times with water so that it is but 20 per cent. of the normal strength may be tried, if two applications of the nitrate of silver are not effective. The glycerite of carbolic acid may serve in very mild cases if applied once every two days. The mouth should be rinsed with warm salt water after each feeding.

CONGENITAL HYPERTROPHY OF THE TONGUE.

A thickened, swollen tongue is always seen in cretinism. (See chapter on Cretinism.) The specific thyroid treatment will usually modify this enlargement. When diseased lymphatics exist we may have a lymphangioma. Such conditions are rare, and if present require surgical treatment.

BIFID TONGUE.

Brothers reported a case of this kind to the New York Pathological Society. The child was one month old, had a cleft tongue and a fissure of the soft palate.

BIFID UVULA.

This condition is occasionally seen. I have seen bifid uvula several times without cleft palate. Some authors report the co-existence of bifid uvula with cleft palate. It requires no treatment.

GLOSSITIS.

An inflammation of the tongue is very rare in children. Some authors state that it is due to traumatism, such as biting the tongue in an epileptic fit, or a ragged, sharp tooth may infect the tongue and cause inflammation. Any irritation, such as caustic acids or alkalies, may cause inflammation.

The following case is interesting:—

A child 1 year old was bottle-fed, and suffered with severe constipation. He was backward in development, had no teeth, could neither walk nor talk. Several adults in the family had influenza and the child was exposed and infected. The fever reached 104° F. There was anorexia, cough, and running of the nose. The tongue was thickened and inflamed and protruded from the mouth. He refused to take any food and seemed relieved when a piece of ice was placed on the tongue. Ice cream was ordered to nourish and cool at the same time. Rectal suppositories containing aconite, 1 minim, and sodium salicylate, 3 grains, were ordered every two hours. Under this treatment, aided by ice applied on the tongue and an ice collar on the neck, the swelling of the tongue disappeared in about four days .

RANULA.

A swelling in the floor of the mouth, located on either side of the frenum, is frequently met with in children. It is a cyst varying in size, and is due to an occlusion of the duct leading into the mouth from the sublingual gland.

Character.—It may be simple or multilocular. It may be of such proportions as to interfere with proper nutrition.

Symptoms.—The symptoms are those of a mechanical obstruction of a non-inflammatory character. It is painless, soft, fluctuating, and contains mucus. The color of the growth is the same as that of the adjacent parts.

Treatment.—An incision should be made to evacuate the contents of the sac. The interior of the sac should be cauterized with iodine or nitrate of silver. In some instances the Paquelin cautery may be required.

ALVEOLAR ABSCESS.

When there is defective hygiene in the mouth and the teeth are not properly cleaned, caries of the teeth results. The carious condition frequently sets up an inflammation, and pyogenic bacteria, gaining entrance, cause abscess formation at the root of the tooth.

Symptoms.—The symptoms are pain, swelling, fever, interference with feeding, foul breath, and general constitutional disturbances. The diagnosis can be made by the presence of fluctuation in the mouth, by the swollen face, mouth, and jaw.

Treatment.—Locally, warm (dry) chamomile bag or warm (moist) flaxseed poultices will have a soothing effect, used externally over the swelling. Rinsing the mouth with warm chamomile tea to which a few drops of listerine have been added is helpful. Painting the gums with tincture of iodine every day will relieve pain. If fluctuation is detected an incision should be made into the gums on the inner surface, and the pus evacuated. If this condition is neglected the periosteum of the jaw may be involved and the pus will burrow and evacuate itself spontaneously, leaving a disagreeable fistula. Cases have been reported where neglect of this condition has resulted in necrosis of the jaw.

ANGINA LUDOVICI.

Angina Ludovici is an inflammation of the cellular tissue of the floor of the mouth and neck. It is probably a form of actinomycosis. The swelling is most marked below the jaw of one side. The symptoms are very intense and both local and general. There are general septic symptoms from the outset. With the swelling there are edema and board-like induration. Redness and the rapid formation of an abscess occur rarely. The throat is not affected. Death takes place from suffocation following coma.

II.

DISEASES OF THE ESOPHAGUS.

ACUTE ESOPHAGITIS.

An inflammation may extend from the pharynx into the esophagus. When such conditions arise the symptoms of pain on swallowing are associated with fever. The treatment consists in giving bland food, milk, and water containing bicarbonate of soda.

CROUPOUS OR DIPHTHERITIC ESOPHAGITIS.

Diphtheria can invade the esophagus as well as it can spread to the larynx. Some authors describe croupous inflammatory patches in the esophagus. I have seen diphtheria of the esophagus and also a diphtheritic patch post-mortem in the stomach of this same case. Such a condition is invariably serious and recovery is rare. *The treatment of diphtheria affecting the esophagus is the same as that described in the chapter on Diphtheria.* When dysphagia occurs and there is an interference with deglutition, rectal feeding may be demanded to save life.

If severe pain exists morphine or codeine should be given in suitable doses. Nausea and vomiting can best be controlled by giving large doses of chloral. If an esophageal stricture remains, then surgical treatment will be required, for which the reader is referred to text-books on surgery.

RETRO-ESOPHAGEAL ABSCESS.

This condition may follow measles, scarlet fever, or diphtheria; in fact, it may be associated with any infectious disease. As a rule, this disease consists of a breaking down of the lymph glands ending in suppuration. In a case seen by me the streptococcus was found. This condition is also frequently associated with tubercular conditions. The following case will illustrate the type most frequently met with:—

A child 3 years old had the following history:—

There was fever, an irritant cough, stertorous breathing, and evidence of obstruction in the larynx. The neck was swollen and the glands enlarged. The temperature was 102° F.; pulse, 130; respiration, 36. At first the case resembled one of laryngeal stenosis as is usually found in diphtheria. The dyspnea was so marked that intubation was suggested. The symptoms of dyspnea continued, and an incision was made into the posterior pharyngeal wall. The abscess cavity extended into the esophagus. Caries of the dorsal vertebræ was associated with this condition. The child died from inanition. The tubercular process was evidently responsible for the abscess, which consisted of pus and large curded masses. The diagnosis was made after a careful study of the case. It is not an easy matter to diagnose this condition, as it is absolutely impossible, in some cases, to reach the abscess cavity by a digital examination of the pharynx.

In the case above reported the dyspnea was very alarming. The literature records cases of spontaneous evacuation of the abscess into the esophagus resulting in recovery, but usually these cases end fatally. The treatment is surgical, and tuberculosis, if present, requires the usual form of treatment. (See chapter on Tuberculosis.)

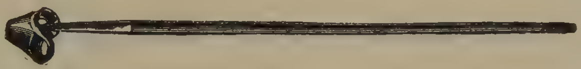


Fig. 60.—Hinged bucket.

FOREIGN BODIES IN THE ESOPHAGUS.

I have frequently been consulted regarding the removal of buttons, coins, etc., which were swallowed. The habit of children to put everything into the mouth should be remembered when buying toys.

The best method of extracting foreign bodies in the esophagus is by means of the hinged bucket; also known as the "coin catcher."

III.

DISEASES OF THE STOMACH.

ACUTE GASTRIC CATARRH (DYSPEPSIA; GASTRITIS).

One of the most frequent diseases met with in infants or young children is dyspepsia. This is due to improper feeding of both quality and quantity of the food. Nursing children are very often seen suffering with this disease, especially among the tenement population. That poor hygiene has some bearing on the development of this disease is certain.

The largest number of cases are seen with bottle-fed babies. Errors in feeding, particularly over feeding, and giving the infant the bottle whenever it cries, must be looked upon as a means of aggravating and exciting gastritis, if not being the real cause of the dyspepsia.

Pathology.—The mucous membrane of the stomach is always swollen and thickened. Occasionally erosions and hemorrhages are found. The tissue beneath the mucous membrane, the submucosa, will be found edematous. The interstitial tissue is infiltrated with leucocytes, and the differentiation between the parietal and principal cells cannot be clearly outlined. All the cells appear cloudy and granular and partially separated from the membrana propria of the gland. There is an abundance of the mucous cells in the pyloric region, and this increase extends deeply into the ducts of the glands.

In older children the origin of the trouble can easily be traced. Overeating, especially cakes and pies and puddings; too rapid chewing and swallowing of unmasticated pieces will aggravate an attack of this kind.

Gastritis is seen more often in older children who are permitted to eat too frequently. Candies and ice creams, when overindulged, frequently cause acute gastritis in children.

Symptoms.—A young infant will suddenly refuse to take its bottle and will appear very peevish and thirsty, flex its legs on its abdomen, will seem dissatisfied, and refuse to play. Vomiting is a frequent symptom. The infant will cry and put its fingers into its mouth. The temperature on the first day ranges between 102° and 103° F., though it may reach as high as 105° F. in the rectum. The pulse ranges between 140 and 160. The respiration is sometimes accelerated. The tongue is usually coated with a white or a grayish-white fur, and there is a fetid odor to the breath. Diarrhea may be present, although constipation is more frequently met with.

When children are extremely anemic, or if from previous malnutrition they are rachitic, the disease will commence with convulsions. Convulsions must not be looked upon as very serious unless they recur several times during the first day of the attack.

A diagnosis of meningitis will frequently be made in the commencement of an acute catarrhal gastritis, unless we study the pulse-rate. In meningitis the pulse-rate is usually slow; in gastritis it is greatly accelerated. Pressure on the epigastrium will show marked tenderness. The stomach is usually distended and tympanitic on percussion.

If a child is old enough to complain, there are usually subjective symptoms such as headache, frontal in character, and pains in the arms and legs will be described. Jaundice will usually be found in older children in the course of the disease, and denotes an extension of the catarrhal inflammation from the stomach into the duodenum; gastro-duodenitis may be diagnosed when jaundice is established

Prognosis and Course.—The prognosis of an acute catarrhal gastritis depends on the time of the year and the condition of the child at the time of the attack. If a bottle-fed infant is attacked with gastritis in midsummer, and it cannot be removed from the sultry city, then the prognosis is grave. If, however, breast-milk can be given judiciously and the feeding interval conform with the requirements of the weak digestive apparatus, then we may reasonably hope for a favorable termination. If complications occur, or an extension of the disease from the stomach into the bowels, then the outlook will not be good, unless we can remove the patient to the mountains or seashore.

Nephritis frequently complicates gastritis, and when such complications exist the prognosis is bad. Infectious diseases complicating gastritis will render the prognosis unfavorable.

The important point to note is, how much food is being assimilated. If the infant digests a proper amount of food the prognosis is good; if, however, vomiting continues and we cannot feed the child per mouth or per rectum, then the prognosis is very grave. We must aim to prevent starvation if the child's life is to be saved.

Treatment.—The first thing to do is to cleanse the stomach. This can be accomplished by giving a dose of castor oil, syrup of rhubarb or calomel. If the child is old enough some citrate of magnesia in wineglassful doses, repeated every two or three hours, will correct fermentation. When rapid cleansing of the stomach is demanded, owing to toxic symptoms from ptomaine poisoning or from other poisons, an emetic should be given. A dose of 1 grain of sulphate of copper in a teaspoonful of water, repeated every half-hour until vomiting is produced, will materially aid in cleansing the stomach. Syrup of ipecac in teaspoonful doses, may also be given in some instances, although the writer does not advocate the use of syrups in acute fermentative diseases of the stomach or bowels. In other cases washing the stomach with a soft catheter as mentioned in the treatment of summer complaint will prove very valuable. Several pints of table salt solution[1] or of normal salt solution can be used to thoroughly cleanse the stomach until the water is siphoned off quite clear. In washing the stomach with the aid of a soft rubber catheter there is usually some irritation produced in the pharynx and esophagus, and vomiting will usually aid the lavage in clearing the stomach of its contents. After such treatment has been instituted it is advisable to allow the stomach to rest at least six or seven hours, and order liquid food and sterile water for one day.

When the bowels have been properly cleansed and the stomach has been washed by lavage, or treated with one of the above-mentioned laxatives, then the after-treatment will consist in preventing further fermentation, and also in toning up the patient's condition.

Einhorn finds HCl rarely or never present in the infant's stomach.

The albuminates of milk combine with the HCl to form acid albuminates.

Experiments have shown that when the gastric contents have been siphoned off or examined immediately after an emetic has been given, in acute gastritis, there is a deficiency of hydrochloric acid. This is an indication as to what is required.

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[1] One dram table salt to a quart of warm water.

Diluted hydrochloric acid given in doses of from 2 to 5 drops has served the writer very well when given every three or four hours.

℞ Acid hydrochloric dilut.	1 dram.
Essence pepsin	2 ounces.

M. D. S, Teaspoonful repeated every two or three hours.

Beta-naphthol bismuth in doses of 1 to 5 grains, every two hours, has served me very well. Calcined magnesia is also very valuable. The following prescription has been used with very good results in dyspeptic conditions attended with constipation:—

℞ Magnesia usta	1 dram.
Pulv. rhei	1 dram.
Saccharum	20 grains.

M. and divide into 12 powders. One powder to be given in a teaspoonful of sterile water every two or three hours.

Powdered charcoal added to the above prescription in doses of 1 grain three times a day is frequently useful. Salol in doses of 1 grain every two or three hours, and resorcin in doses of 1/10 grain or 1/4 grain, for a child 1 year old, repeated three times a day, will do good in some instances.

A very good liquid preparation sold in drug stores is milk of magnesia (Phillip's). It is an excellent antacid and corrective when flatulence exists.

When severe thirst exists boiled water may be given. This water may be acidulated with a few drops of diluted phosphoric acid, and will be found not only very grateful and cooling, but very serviceable if the child has a tendency to diarrhea in midsummer. Bulgara tablets after meals correct flatulency.

Dietetic Treatment.—The most important point to remember is the feeding. If we are dealing with the nursling, then breast-milk should be withheld for about one-half day. When the breast is given again, the infant should not be permitted to nurse more than two or three minutes, and immediately after taking the breast the infant should receive 3 or 4 ounces of sweetened rice water. In this manner we will give the infant diluted milk. This breast and rice-water feeding should be repeated in four hours, no sooner, no matter what the age of the infant.

What might appear very radical is simply advised to prevent the stomach from performing its usual amount of work until the gastric function is reëstablished. If, however, the child's appetite warrants it, then one or two days should elapse before giving it its former regular quantity of nursing. The guide to the return of the normal quantity of nursing will be the disappearance of the fever and of the accelerated pulse-rate. The child's craving for the breast can be noted chiefly by constant crying when removed from the breast, and the ravenous manner in which it nurses.

In bottle-fed babies it is advisable to give the child one-half of the former quantity of milk or cream which it received at the time of its illness, and if it is found that the sugar contained in the food aggravates this condition, a small quantity of saccharine may be used to sweeten the milk, and the sugar discontinued. Some children show distinct fermentative changes after the use of too much sugar. In such cases the use of saccharine or one-half teaspoonful of glycerine to each bottle of milk is sometimes beneficial as a temporary substitute.

Glycerine is absolutely harmless and may be given for months with impunity. My rule is to insist on the use of sugar if at all possible. Lime water in doses of a teaspoonful or a tablespoonful may be added to the milk. Five grains of bicarbonate of soda may be added to the milk or given before each feeding. If vomiting follows the milk-feeding, whey should be substituted or barley water in 4 or 6 ounce feedings.

If milk seems to aggravate an attack of dyspepsia, then Zoolak or Kumyss or other fermented milk may be tried. Buttermilk is very nourishing and very useful in dyspepsia. Junket may also be tried; so also can whey be given several times a day. Soups and broths, calf's foot and chicken jellies are all nourishing. Steak juice and unfermented grape juice will be serviceable. Boiled fruits, such as apples and peaches, if the child is old enough and the condition warrants it, may be tried.

Our aim must be to have the infant fed after a large interval of rest, so that nausea and vomiting may be prevented, and the food properly assimilated. We must therefore give small quantities with large feeding intervals. When the functions are again normal then we can return to a judicious, nutritious diet, as demanded by the infantile stomach. It is advisable to give nux vomica in doses of 1 minim for a child, 1 to 3 years old, three times a day before feeding, and to continue the same for months after the gastritis disappears. The writer has seen the most marked improvement following the use of this drug, and regards it as a specific for toning the stomach.

Malt extract should be given in doses of a half teaspoonful, three times a day, to aid nutrition. It is well known that malt has a decided laxative effect. Care should be taken that fermentation is not reëstablished while giving malt. In some cases it is not well borne in the commencement of an acute gastritis, and a total abstinence of milk and the substitution of boiled water, whey, soups and broths may become necessary; very weak tea, to which the white of a raw egg has been added and sweetened with saccharine or with granulated sugar, can be given with advantage.

Fever.—The temperature in the course of an acute gastritis requires no antipyretic treatment, although sponging the surface, or a cold pack applied over the thorax and abdomen, will be serviceable. A tub bath will reduce temperature most rapidly without depressing the heart, and usually promotes sleep. (Read chapter on Hydrotherapy.)

Specific fever treatment is uncalled for. The well-known depressing effect of antipyretic drugs must not be forgotten, and hence the specific cause of the disease must be removed. This is usually stagnant food. The same requires cleaning out with calomel or cascara. The cause of the fever will be removed with such effectual treatment.

When children have a tendency to convulsions then a mustard foot-bath can be given and an ice-bag applied over the anterior fontanel or at the nape of the neck. In such instances the most rapid treatment will be called for, such as washing the stomach with a catheter, using warm salt water. An emetic will prove useful in those cases where lavage cannot be successfully carried out.

Alcoholic stimulation is contraindicated in every form of gastric fever. The writer has always seen bad results follow the use of whiskey when the gastric mucous membrane was inflamed. If, however, the patient is threatened with collapse or the pulse is very weak, then small doses of musk in the form of a tincture of musk can be injected hypodermically, every hour, until the pulse-rate improves, or strychnine $\frac{1}{100}$ grain every 3 hours.

Hot coffee may be given in small doses, two or three teaspoonfuls repeated every fifteen minutes, until its physiological effect is manifested.

SIGNIFICANCE OF VOMITING.

The symptom of vomiting needs careful interpretation. When the symptom occurs in gastric and intestinal conditions it is not difficult to make a diagnosis. It is important to note the frequency of vomiting: Does or does it not occur after every feeding? Has the infant had a stool during the last twelve hours? Intestinal obstruction is usually accompanied by frequent vomiting and the absence of stool. Intestinal worms are frequently a cause of vomiting. Likewise, an early symptom of appendicitis is vomiting. Feeding high percentages of fat may provoke vomiting; likewise, excessive quantities of sugar may produce vomiting as well as colic from flatulence. Pyloric spasm and pyloric stenosis are usually accompanied by vomiting.

Vomiting is a reflex act. It can be produced directly by irritating the stomach, as, for example, when mustard is swallowed. It can also be produced by centrally acting emetics, as, for example, by apomorphin. Minerals such as sulphate of zinc or turpeth mineral, or sulphate of copper, will produce violent emesis by their local irritant action. Bacterial fermentation from stagnant food can also produce vomiting. These causes are, therefore, direct in their action and produce immediate results. It is a great mistake to look upon the stomach or stomach contents as the etiological factor in all vomiting.

The toxins in the blood of many acute infectious diseases produce vomiting. One of the earliest symptoms of scarlet fever is vomiting. Several days before the eruption of scarlet fever appears, vomiting of a most violent nature generally occurs. This is, no doubt due, to toxemia.

An irritation of the vagus or the pneumogastric nerves can result in vomiting. Any irritation brought about through the central nervous system will cause vomiting; thus it is that shock, fright, or disturbance of metabolism may produce vomiting of a most serious nature.

Giddiness, caused by swinging or a rolling motion, as on a ship, may produce cerebral hyperemia, ending in vomiting.

When a child falls on the back of its head and produces concussion of the brain, we have continued vomiting as a first symptom. When vomiting persists in spite of gastric treatment, meningeal disease should be suspected. In meningitis, especially in hydrocephalus, vomiting is a frequent symptom. The writer does not presume that any physician will diagnose brain fever, scarlet fever, or gastric fever by the single symptom of vomiting.

On the other hand, it is well to know that vomiting, with a suspicious rash and a sore throat, will strengthen the suspicion of an existing scarlet fever. A rule followed by the writer is to lay considerable stress on vomiting. It means nothing if we are dealing with a spoiled stomach following a large dish of plum pudding. But a guarded prognosis must be given where vomiting is an early manifestation of intracranial disease.

CYCLIC VOMITING.

This is a condition seen in apparently well nourished infants and children up to five years of age. The condition is characterized by periodic vomiting, generally after meals. The vomiting may take place after each meal or only every few days. Very often it resembles an ordinary upset stomach. The origin is obscure. Acidosis, due to incomplete burning of fats, is thought by some to be a contributing factor. This idea has been substantiated by post-mortem findings in children who have had periodic vomiting. The liver of such children shows fatty degeneration due to either insufficient carbohydrate in the diet so that the fats are not completely metabolized or else there is too much fat in the diet for the liver to deal with. This in itself is sufficient to account for the cyclic vomiting. There seems to be a neuropathic influence, likewise, blondes seem to be much more susceptible than darker children. The disease is furthermore generally found in well to do families. A chronic appendicitis is a factor in only a few cases and removal generally does not benefit. Byfield[1] recently has brought evidence forth in favor of the view that bad tonsils are an etiological factor. In 50 per cent. of his cases he had no recurrence after tonsillectomy. Even though the tonsils may appear normal Byfield thinks that they may be the disturbing cause.

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[1] BYFIELD: Amer. Med. Convention, Boston, June, 1921.

STOMACH WASHING.

When vomiting persists, especially in pyloric spasm, stomach washing (lavage) is indicated. One teaspoonful of bicarbonate of soda added to one pint of warm water can gradually be introduced by pouring through a funnel attached to a soft rubber or flexible catheter. While many clinicians advise placing the child in an upright position during the lavage, I have found, especially in younger infants, that it is easier to fill the stomach and siphon off the gastric contents while the child is flat on its back. In the dorsal position the tube can be gently but quickly forced over the tongue, down the pharynx, through the esophagus, into the stomach. In washing the stomach the funnel, holding three or four ounces, should be filled, and raised above the level of the stomach. After the fluid has entered the stomach, we can siphon off the contents by lowering the funnel below the level of the stomach. This process should be repeated several times or until the return flow from the stomach is clear.

It is advisable to wash the stomach before food has been given. In obstinate vomiting lavage should be performed daily. No force should be used in pushing the tube into the stomach. The eyelet of the catheter should be carefully inspected to see that there are no sharp edges. An injury to the gastric mucosa by laceration with a sharp border of a stomach-tube will certainly result in an erosion.

PYLORIC OBSTRUCTION CAUSED BY SPASM OF THE PYLORUS.

The symptoms of obstruction of the pylorus, due to spasm or obstruction due to hypertrophy, are strikingly similar. It is difficult to differentiate the same in many cases. In the one, the spasm is a benign condition which yields to and is frequently overcome by mild and palliative remedies. In stenosis, however, we have a serious condition and one that has cost many lives, despite proper surgical measures.

Causes.—The most frequent cause of pyloric spasm in infancy is due to irritating food, that is, food containing excessive high fat and high proteins. Another cause of pyloric irritation resulting in spasm is seen when human milk is suddenly withdrawn and cows' milk substituted. When there is deficient peptic secretion, including hyperacidity, such condition as spasm may be caused by stagnation of the gastric contents.

Common Symptoms.—Infants so affected will cry continuously from the pain of the spasm. The stool does not usually show special features, it is neither constipated nor loose. The most noteworthy symptoms in this condition are vomiting and pains or regurgitation. Said vomiting will follow soon after food reaches the stomach. In some cases all of the food partaken will be ejected; in other cases small quantities will be vomited at intervals. On placing the infant in the dorsal position antiperistaltic waves can be noted by inspecting the abdomen. These waves are seen after food is taken. These worm-like movements disappear when the stomach is empty. From the loss of food and improper nutrition there naturally results loss of weight. When the spasm yields, the food will pass into the duodenum, and resulting therefrom there will be more or less feces evident. If, therefore, stool is noted, then spasm of the pylorus and not stenosis exists.

When an obstruction due to a pyloric hypertrophy and stenosis exists, there results usually a dilatation of the stomach from the stagnation of the gastric contents. The evacuations following colonic flushing will bring away some jelly-like or greenish masses, but milk feces will not be found. This is an important diagnostic point and will differentiate the spasmodic from the stenosed condition.

In suspected or congenital pyloric stenosis Nobécourt[1] and Merklin have shown that normal children, 3 months old, will, by giving 0.015 gram of carmine, in three to nine hours pass a red stool. Therefore, the retention of carmine must prove an anatomical obstruction somewhere in the digestive tract.

Diagnostic Aid.—A small metallic bucket, devised by Einhorn, somewhat smaller than an ordinary sized pea, is fastened to a white silk cord.

This bucket is introduced into the stomach by placing it on the tongue and feeding the infant a bottle of water or food. The infant swallows the bucket and the same is allowed to remain in the stomach over night. When pyloric stenosis is present the bucket remains in the stomach. If, however, there is no stenosis the bucket will pass into the duodenum, and the *bile-stained*

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[1] Nobécourt and Merklin: Bull. d. la Soc. d. Pédiatrie. 12. I. 1910.

string will show the probable depth that the bucket entered the duodenum.

I choose the evening feeding time or about 6 P.M. as the best time for introducing the bucket, then give the infant the regular feeding, and with very few exceptions the same was retained. If, however, the bucket was expelled by vomiting it was reintroduced at the next feeding. To be sure that no obstruction to the duodenum existed, I left the bucket in over night. On withdrawing the same after about twelve hours, a yellowish bile-stain from the duodenal bucket for at least 8 to 10 centimeters will be noted on the cord. In pyloric obstruction, however, *no bile-stain* was noted.

By this method of diagnosis we can learn whether or no pyloric stenosis is present. It is an important aid if surgical relief is demanded.

Instead of a cord, a thin rubber tubing attached to and ending in a perforated bucket can be passed into the stomach, and by leaving it there several hours the bucket will pass through into the duodenum. By means of a little glass syringe, I was enabled to aspirate bile, in some cases a greenish, in other cases a yellowish fluid, alkaline in reaction and of viscid consistency.

There are three ferments for which a test can be made. They are: (*a*) steapsin, (*b*) trypsin, (*c*) amylopsin.

(*a*) To test for steapsin, take 1 drop of neutral milk, 2 drops of water, 2 or 3 drops of duodenal contents (neutralized if the reaction is acid), and a small piece of blue litmus agar. This is placed into a miniature test tube and kept at blood temperature. If steapsin is present the agar will be red in twenty to thirty minutes, owing to the development of fatty acids.

(*b*) For the demonstration of trypsin a small piece of the white of a hard-boiled egg is placed in the fluid to be examined (if acid, it is first neutralized) and kept a few hours at blood temperature. The piece of egg albumin disappears in the presence of trypsin. The ricin test used for pepsin is unsuitable for trypsin. If we add ricin solution to duodenal contents and leave it at blood temperature for a few hours, and then add hydrochloric acid or acetic acid, the ricin will often be precipitated, *i.e.*, it will not be changed into soluble peptone.

(*c*) Amylopsin. In testing for the presence of diastase we make use of a boiled starch solution or starch paper. We mix the duodenal contents with the starch solution (in equal parts), or insert a strip of starch test paper and leave it at blood temperature for one-half to one hour, adding a weak solution of iodine. Starch, if present, gives a blue color, and erythrodextrin a red color; otherwise there is only a trace of brown from the iodine.

Thick cereal feeding has been advocated by Finkelstein, of Berlin, Mixsell, Rogatz, and others, with remarkable success. Either farina or cream of wheat, so thick that it hardly pours from the spoon, is adapted for this use.

At the Infantorium excellent results are obtained in pyloric cases.

Atropine in hypertonic conditions, 1 drop of an atropine solution, gradually increased until two drops are given at each feeding.

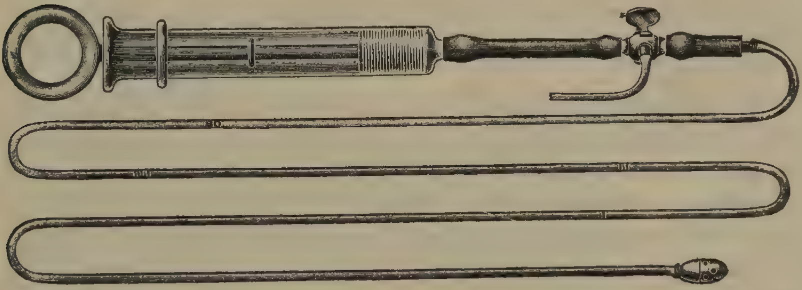

Fig. 61.—Infantile duodenal bucket with syringe attached, to aspirate bile.

℞ Atropine sulph. .... gr. j;
Aqua .... ℥j.

Add 1 drop to each feeding.

HYPERTROPHIC PYLORIC STENOSIS.

This condition is not so rare in infancy as is commonly supposed. While in 1902 Cautley and Dent reported 109 cases, we have since then over 150 cases recorded in medical literature.

Etiology.—Stenosis may occur as a congenital malformation. Hyperacidity is believed to be responsible for some cases of spasm of the pylorus resulting in hypertrophy. Thomson believes that by the ingestion of liquor amnii in intra-uterine life both the stomach and pylorus are excited to over-action, due to the presence of this irritant fluid.

Morbid Anatomy.—Under normal conditions the circular muscle fibers of the pylorus at birth are relatively augmented, gradually approaching the normal as the long axis of the stomach assumes its horizontal direction from the vertical; this relative augmentation of the circular fibers is intended to prevent the too rapid emptying of the vertical tubular infantile stomach during the first two weeks of life. These fibers, stimulated to excessive function by any given cause, must, according to recognized physiological principles, become hypertrophied.

Accepting such a working basis, we should recognize in hypertrophic pyloric stenosis the ultimate result of a pathological process whose first stage is represented by an excessive functional activity of the pyloric musculature; its second stage by hypertrophy and spasm of this musculature, and the third stage by a general overgrowth of the normal constituents of the involved parts.

Symptoms.—Sometimes an apparently well infant articially fed who has gained in weight and had sufficient and well digested stools begins to vomit persistently and forcibly. The vomiting is of an explosive character. The infant has been in good health until its fifth, sixth or seventh week of life, when this sudden change takes place. In addition to vomiting there is constipation, steady loss in weight and disturbances of metabolism. The most noteworthy symptom in the diagnosis of this condition is the explosive character of the vomiting. If food is retained from a previous meal then the quantity of food ejected is greater than the amount taken at the last feeding. There is neither fever nor loss of appetite. Owing to the continuous vomiting the infant is always hungry. Gastric peristalsis is usually present, the waves passing from left to right. These peristaltic waves occur soon after feeding. A small movable mass about 2 centimeters in diameter and 3 centimeters long can be felt to the right of the navel and a little above it. While the presence of a mass strengthens the diagnosis its absence by no means excludes hypertrophic stenosis. When in doubt a bimanual examination should be made, the palm of the left hand pressing from behind while with the tips of the fingers of the right hand the tumor is palpated. Even though one cannot feel an increase in the size of the pylorus, if all other symptoms are present the diagnosis of hypertrophic stenosis may still be made.

If in doubt the abdomen should be explored under an anesthetic. The use of the Roentgen ray in conjunction with a bismuth meal as an aid to the diagnosis should be utilized. I have had valuable aid by this means in verifying the diagnosis.

Treatment.—There are two forms of treatment, medical and surgical. The medical treatment consists in washing the stomach at least once a day with 1 pint of warm water to which has been added 1 teaspoonful of bicarbonate of soda. Temperature of irrigation should be 100° F.

In addition to stomach washing one must try to procure human milk. If human milk cannot be procured then an easily digested milk such as Dryco should be given.

If the symptoms such as vomiting and loss of weight continue, an operation should be advised. If marked prostration exists a hypodermoclysis of a 4 per cent. solution of dextrose or glucose in 50 cubic centimeters normal saline solution should be given daily. Constipation is best relieved by an enema.

Rammstedt[1] advises external muscle division as a substitute for gastroenterostomy, divulsion and pyloroplasty. Since then the Rammstedt operation has been used extensively at the Babies Hospital in New York City, by Downes. The operation is a simple one, it requires but ten to fifteen minutes. As the stomach is not opened the risk of leakage and peritonitis are eliminated. Due to the short time required for the operation as compared with the older methods there is less danger of shock.

To obtain good results every detail must be carefully supervised. The room should be warm and the patient kept warm with artificial means. Warm blankets and hot water bags should always be at hand. Before the operation the stomach should be washed. Stimulation if necessary should be given hypodermically. Epinephrin 3 to 5 minims of a 1 to 1000 solution gives excellent results. It may be repeated several times and lessens the amount of shock.

Feeding.—Before feeding the infant it should be put in a semi-erect posture. This facilitates the expulsion of gas. Human milk should be given, 2 or 3 drams diluted with an equal quantity of water, and given by medicine dropper, it can be repeated every three hours. Feeding may be commenced as soon as the infant has recovered from the anesthetic. At the end of the first twenty-four hours the infant has usually taken 4 or 5 teaspoonfuls of human milk in addition to the water. At the end of two days about 1 ounce every three hours, gradually increasing until 2 ounces are given by the fifth or sixth day. The infant may be put to the breast, if strong enough, at the end of a week or ten days, not sooner. The first few nursings should last but two or three minutes. Human milk is imperative and must be procured from the infant's mother or from a wet-nurse.

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[1] RAMMSTEDT: Med. Klin., 1912, **8**, 1702-1705; Zentralbl. f. Chir., 1913, 11, 3.

If human milk cannot be procured then goat's milk diluted with an equal quantity of water should be given. If neither human milk nor goat's milk can be procured then dried milk (Dryco) is the next choice.

As a routine practice at the Babies Hospital a teaspoonful of castor oil is given daily beginning with twenty-four hours after the operation. In addition to soothing the infant it cleanses gas and mucus. When diarrhea follows the operation due to excessive peristalsis then small doses of bismuth may be necessary. Fat-free milk or protein milk will usually modify loose bowels. This may be used as an alternate feeding with the human milk.

The successful outcome of a case depends on the attention to every detail during the first week following the operation. The aim must be to conserve the strength by giving the proper nutrition as previously stated.

The patients operated at the Babies Hospital were 41 gastro-enterostomies with a mortality of 51 pr cent.; of the 28 cases in which operation was performed by Downes, the mortality was 43 per cent. Of the 63 cases in which the Rammstedt operation was performed, the mortality was but 24 per cent.[1]

Hypertrophic stenosis may exist for years before giving rise to symptoms. A case of this kind is reported by Rosenheim. This boy had been in good health until five years old. He then began to vomit occasionally, complained of subjective abdominal pains. Faint antiperistaltic waves were visible. The symptoms persisted, and at the age of 6½ years an operation was performed and the diagnosis confirmed.

Holt reports a case of pyloric stenosis in a child 4½ years old in which definite gastric symptoms did not appear until the child was 3 years old. Occasionally infants have definite gastroenteritis in which vomiting and loose bowels are the prominent symptoms. These symptoms persisting should always lend suspicion to the existence of a pyloric stenosis.

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[1] HOLT: Journal of the Am. Med. Assn., 1917.

GASTRODUODENITIS (CATARRHAL JAUNDICE).

When the infection of an acute catarrhal gastritis extends into the duodenum, jaundice usually results. This is due to an involvement of the common bile ducts.

Symptoms and Diagnosis.—Yellowish pigmentation of the skin and conjunctival mucous membrane are noted. The urine is brown or deep yellow. The stool is whitish or clay-colored. The temperature ranges between 100° and 103° F. Anorexia and thirst usually exist. Nausea or vomiting may occur. The pulse is full and regular. The liver is usually enlarged.

Treatment.—Elaterine or podophyllin, $\frac{1}{20}$ to $\frac{1}{10}$ grain, repeated, if necessary, in three hours, or phosphate of soda, 10- to 20- grain doses every three hours until liquid stools are produced. Dilute nitro-muriatic acid, 2 to 5 drops, may be given twice a day. Liquid food, such as thin soups, diluted milk or skim-milk or buttermilk, and fruit juices may be given for thirst.

CHRONIC GASTRITIS (CHRONIC GLANDULAR GASTRITIS —CHRONIC VOMITING).

This is a chronic inflammatory disease affecting the gastric mucous membrane. The functions of the stomach are disturbed owing to the large quantities of alkaline mucus being excreted. There is a distinct loss of tone in the gastric mucosa. Large quantities of food will frequently stagnate, causing fermentation and vomiting.

Pathology.—The changes in chronic gastritis, seen postmortem, are similar to those met in the acute form. There is a degeneration of the epithelium of the gastric tubules. Frequently there is dilatation of the stomach.

Microscopically the glands often seem enlarged, sacculated, and dilated in cyst-like forms. Ewald states that there is a mucoid degeneration. When there is a total destruction of the glandular layer of the entire organ, we have an atrophic condition which Ewald calls anadenia ventriculi.

Symptoms.—Vomiting is a prominent symptom. Large quantities of sour or bile-stained mucus are ejected. At other times sour-smelling liquid containing particles of food is ejected. Farinaceous foods cause particular distress. Pains referred to the abdomen are complained of, and the abdomen is usually distended and tender on palpation. The tongue is coated. The papillæ are enlarged and the edges and tip are of a bright glazed red. Eructations of gas are frequently noted, especially after feeding.

The Bowels.—Constipation alternates with diarrhea in this condition. We find a child will suffer with constipation for three or four days, and for no apparent reason a diarrhea will appear and continue for a week or more. Eczema is usually associated with this condition. There is usually anorexia. Owing to the malnutrition, such children appear underfed and seem to be anemic. They emaciate from loss of sleep in addition to the continued vomiting. Their extremities are usually cold, owing to a poor circulation. Headache is a prominent symptom in children old enough to complain. The clinical picture is such that one must take extreme care to make a proper diagnosis. Frequently there is a hacking cough present. We may exclude tuberculosis if the pulmonary signs are wanting in addition to the absence of the tubercle bacillus.

Diagnosis.—The diagnosis is easily made if we remember that tuberculosis has fever which at times assumes a hectic form. We have previously mentioned the necessity of finding the tubercle bacillus if tuberculosis is suspected. Typhoid fever is so different that we can easily differentiate this by resorting to the Widal and diazo reactions and by doing a white cell count.

Prognosis and Course.—This condition should be looked upon as every other chronic disease in which vitality, surroundings, and proper care play an important part. If a child of a poor family living in a tenement house suffers with this chronic disease, the outcome will be different than if the child were living in the country, where fresh air could and would stimulate metabolism. Rarely is this condition fatal, although with extreme emaciation and continued vomiting inanition may cause death.

Treatment.—*Dietetic Treatment.* This is the most important factor. The feeding interval should be extended so that the child should be fed less often than formerly. The quantity of food should be reduced so that the stomach receives less work. By all means give food that is easily assimilated. In some cases nothing but predigested food or peptonized milk will be retained. Each child should receive a carefully prepared diet list, and we must insist on strict rules. Give older children soups, broths, white of egg, and peptonized yolk of egg. Give infants diluted milk or one of the infant foods temporarily. When vomiting persists and apparently little or no food is retained, it is advisable to put the child to bed and resort to rectal feeding for two or three days. This is one of the best means of allaying gastric irritability. (See chapter on Rectal Feeding.)

Hygiene.—Without fresh air, active exercise, such as walking, or passive movements, such as massage or gymnastics, we must expect little or no benefit. Daily sponging or bathing, followed by friction with a coarse towel, will stimulate the circulation.

Medication.—Stomach washing, by using 1 or 2 pints of warm water to which bicarbonate of soda has been added, is very useful. This may be repeated every day. Sodium phosphate, in 5- to 10- grain doses, every morning or evening, is indicated.

Fowler's solution, in 1- to 5- drop doses, three times a day, and nux vomica, in 1-minim doses, three times a day.

Bismuth subnitrate or bismuth beta-naphthol, to relieve the diarrhea, are very valuable remedies.

For persistent vomiting menthol, in 1-grain doses, and oxalate of cerium, in 2- or 3- grain doses, every few hours, are useful. Gentle currents of faradic electricity will also aid and correct the atonic condition.

ACUTE DILATATION OF THE STOMACH.

This condition is quite frequently met with in children.

Etiology.—The anatomical and physiological peculiarities of the infantile stomach render it peculiarly susceptible to the development of this condition. The walls of the stomach are thin. The weakness of the resistance of the muscular walls and the ease with which a general anemia and resultant muscular atony occur in children must be remembered in considering etiological factors. Rachitis plays an important part in the development of this condition. Severe gastric catarrh with associated fermentative conditions are predisposing factors.

Pathology.—A general atrophied condition of the entire gastric wall exists. The muscular coats are frequently thickened.

The mucous membrane shows evidence of chronic catarrh. This condition is usually seen in marasmic or rachitic children. The stomach is invariably dilated.

The symptoms of this condition correspond to those of chronic gastric catarrh. In standing the child upright the contour of the greater curvature of the stomach can be made out if emaciation exists. Vomiting is a prominent symptom, a sour, frothy liquid being thrown up. Succussion is frequently heard, but cannot be depended on as a positive symptom in this condition. Children suffering with acute dilatation usually have a very good appetite. They always show evidences of malnutrition. The results of percussion are very misleading. A tympanitic sound may be heard when the child is on its back. It may also be absent. Henoch states that severe dilatation of the

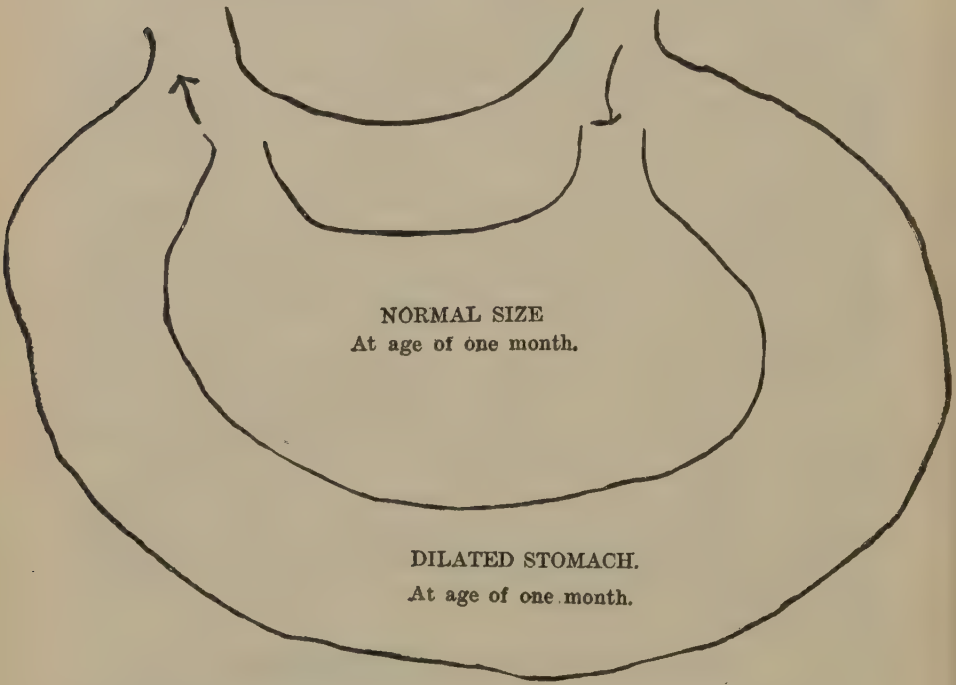

Fig. 62.—Drawing from a case of acute dilatation of the stomach, giving exact size post-mortem. Bottle-fed infant. Summer complaint, due to overfeeding, and too frequent feeding. Compare normal size with the dilated condition.

stomach in a child may cause dyspnea. It may also displace the heart if dilatation is severe.

Diagnosis.—The diagnosis can usually be made by the symptoms above described. It is important to remember that a dilatation of the colon may exist at the same time; if so the differentiation between dilatation of the colon and dilatation of the stomach can be made by artificially distending the stomach with the aid of a Seidlitz powder. Translumination of the stomach with the aid of a gastrodiaphane or a radiograph will aid in mapping out the anatomical outlines of the stomach.

Prognosis.—This depends on the condition of the child when treatment is commenced. If the child is physically debilitated and does not assimilate food, the prognosis is grave. It is safest to give a cautious prognosis in every case.

Treatment.—Semi-solid foods should be given, if possible, and large quantities of liquids avoided. The normal tone of the stomach can best be restored by the administration of nux vomica and iron in suitable doses. The value of electricity and massage must be remembered. They will restore the tone of the stomach when judiciously used. Specific conditions such as rickets and syphilis, if present, require special treatment.

BULIMIA (ABNORMAL APPETITE).

Constant desire to eat is frequently seen when intestinal parasites, such as tapeworm, are present. It is also found as a symptom of hysteria.

A. B., 7 years old, desired five and six meals a day. Her body was emaciated and occasional abdominal pains were described. The mother attributed the pains to overeating. After several doses of filix mas a tapeworm was dislodged (see treatment in the chapter on Tapeworm) and the bulimia disappeared.

GASTROPTOSIS (DESCENSUS VENTRICULI), LOW POSITION OF THE STOMACH.

We are indebted to Glenard for emphasizing sufficiently the clinical symptoms due to this condition.

Etiology.—In subnormal conditions such as chlorosis or where a general atony exists, a weakening of the ligaments takes place and the abdominal viscera consequently descends. Very tight lacing is frequently a cause in young girls.

In a series of autopsies made by Glenard he found the transverse colon displaced and stenosed.[1]

Symptoms.—A variety of nervous symptoms such as irritability, headache, restlessness by day and insomnia by night, is frequently due to this disorder. The symptoms which characterize nervous dyspepsia in the adult correspond with the train of symptoms noted in this condition. Constipation is usually present; there are loss of appetite and eructations.

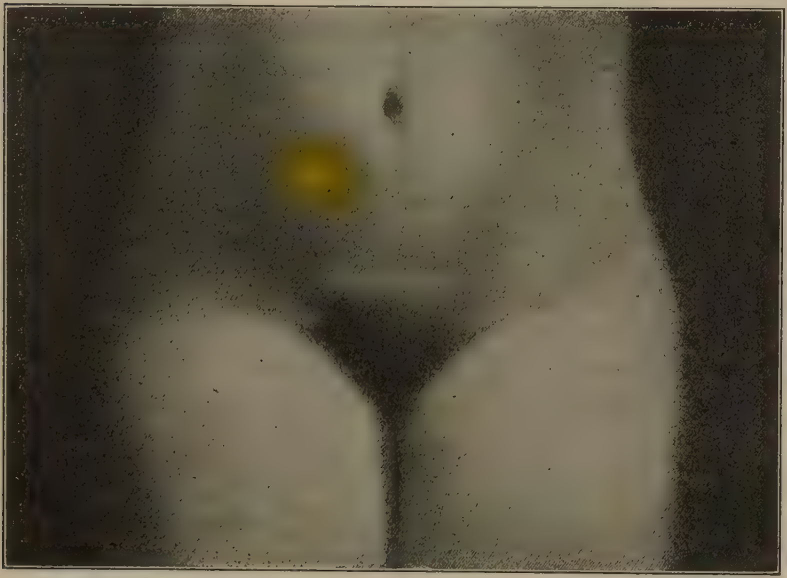

Fig. 63.—Translumination of the stomach with the aid of a gastrodiaphane, in a case of gastroptosis.

Diagnosis.—Ewald advises inflation of the stomach as the best means of diagnosis. When the stomach is inflated the lesser curvature, in cases of gastroptosis, is visible midway between the ensiform process and the navel, or just in the neighborhood of the umbilicus. With the aid of the gastrodiaphane we can transluminate the stomach and make out the contour of the same. This has been found a valuable means of diagnosis. The red illuminated area can be plainly made out if the room is darkened. A radiograph will confirm the diagnosis. The following case illustrates this condition as met with in practise:—

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[1] EINHORN: "Diseases of the Stomach."

Rosie B. was first seen by me when 13 years old.

Family History.—Father and mother living and well. She had six sisters and one brother living, all in good health. There was no family history of syphilis, rheumatism, or tuberculosis. One child of 3 years died from pneumonia complicating measles.

Personal History.—She was a breast-fed child and appeared to be well developed. She had measles and with it bronchitis. Menstruation appeared when she was 13 years old and lasted seven days. She complained for the last two years of headaches, pains in the back and abdomen, loss of appetite, and did not sleep well. She was very nervous and had a peculiar unilateral twitching involving the right arm and shoulder. This twitching appeared spasmodically and was exaggerated when her attention was directed to it. She complained of cold extremities, and had an occasional cough. No expectoration. The cough appeared to be of the same character as that seen in adults which is described as a hysterical cough.

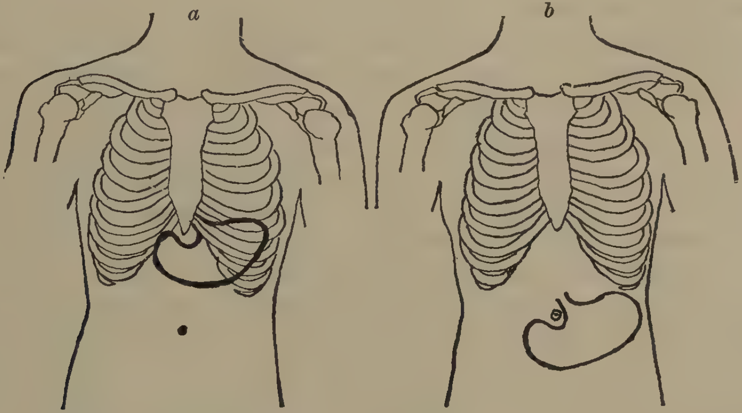

Fig. 64.—(*a*) Normal position of stomach. (*b*) Position of stomach in a case of gastroptosis.

The chemical examination of the gastric contents siphoned off one hour after feeding a test meal of tea and zwieback gave the following: 25 cubic centimeters obtained, color greenish yellow, very tenacious, ptyalin present in saliva. Reaction of gastric juice acid, no free hydrochloric present, lactic acid absent, peptones present, sugar present, starch present, combined hydrochloric acid present, estimated by titration equals 0.02 per cent. hydrochloric acid. A splashing sound could be made out on the left side of the abdomen in the area bounded by the umbilicus or above it to the symphysis pubis. With the aid of the gastrodiaphane the outline of the stomach could be plainly seen extending below the umbilicus. In the accompanying illustration (Fig. 64) the position of the stomach is outlined.

Prognosis and Course.—A displaced organ is not easily replaced by giving drugs or by mechanical devices. The physician should inform the patient's relatives regarding the true condition. The life of the child is not necessarily endangered by the displaced stomach, yet the abnormality should be treated on the principle of general building up of the entire system with special reference to the diet.

Treatment.—The treatment of these cases consists in building up the system with the aid of electricity, massage, and general restorative treatment; cold sponging with brisk friction of the surface of the body to stimulate the circulation; also, light bodily gymnastics. Nux vomica or its alkaloid, strychnine, should be given for a long time.

A tight-fitting abdominal bandage has frequently relieved acute symptoms. Boas, of Berlin; Einhorn, and Kemp, of New York, are among those who advocate supporting the abdominal muscles by this mechanical device.

Surgical Treatment.—When no relief is obtained by the abdominal supporter or bandage previously referred to, then surgery may be demanded. Some surgeons advise supporting the stomach by means of stitching the omentum to the abdominal peritoneum. By this means we have a method of suspending the stomach in a hammock made by the great omentum.

ULCER OF THE STOMACH.

Gastric ulcer is frequently seen in chlorotic girls. It is usually the result of living in unsanitary surroundings, or when the body is reduced to a subnormal condition. Young girls at or about the period of menstruation that are sent to work in factories or shops, who cannot take proper time for their meals, are occasionally seen with evidences of gastric ulcer. In most cases the ulcer is simply a continuation of a chronic catarrh of the gastric mucous membrane which has laid the foundation for this condition.

Symptoms.—Pain in the stomach, which is distinctly localized and can be pointed to in the same area. The pain increases after taking solid food, although pain is also noted when any liquid enters the stomach. At times bright red blood will be expectorated, although the blood may be very dark in color. There is also a tender area, usually localized between the ninth and tenth dorsal vertebræ, which is marked on palpation.

Diagnosis.—Erosions of the stomach and especially gastric ulcer can be readily diagnosticated with the aid of the x-ray. One should not rely on the diagnosis by fluoroscopic examination. Giving a child a feeding of thick milk, such as buttermilk, to which barium sulphide or bismuth subnitrate is added will give a very positive picture of an ulcer, if present.

The interpretation of the plates should be left to one skilled in such work. The average physician is not competent to diagnose an ulcer on an x-ray plate. While a test meal and the examination of the gastric contents may help in arriving at a positive diagnosis, we should not introduce a tube into the stomach because of the danger of traumatism. This diagnostic measure is contraindicated in every form of gastric ulcer.

The following case of gastric ulcer serves as an example:—

Mary B., 13 years old, complained of headaches and general weakness. She was emaciated and had anorexia. She had suffered with constipation, dizziness, nausea, and vomiting. Her heart action was irregular. For four years she complained of pain in the middle of the stomach which was always localized in the same area. The gastric pains were strongest after partaking of solid food. She had pain whenever any food, solid or liquid, was swallowed. The pain was described as a burning pain. She had a tender area between the ninth and tenth dorsal vertebræ. This tenderness was marked on palpation. Three years ago she had an attack of hematemesis, but none since then. The gastric contents were examined after a test meal, and an excess of HCl was found. Owing to the danger of traumatism I thought it best not to repeat the syphoning off of the gastric contents, as there was a risk in repeating the hemorrhage. There was no evidence of hysteria in the case. The diagnosis of gastric ulcer was made.

Treatment.—Liquid diet, rest in bed, and bismuth gave quite some relief. When solid food was tried the gastric pain returned.

Prognosis and Course.—Great care should be taken before giving a positive opinion concerning the outcome of gastric ulcer. If the conditions that induced the disease can be modified, then a chance for recovery exists. These cases, as a rule, do badly unless placed under the strictest supervision of a trained nurse. Such cases require treatment in bed, rather than being permitted to walk about. Months of patient treatment may be required before a cure is effected.

TABLE No. 33.—INFANT MORTALITY STATISTICS FOR TEN LARGEST CITIES.

Cities.	1919.	1918.
St. Louis	75.2	94.4
New York	81.6	91.7
Philadelphia	89.8	123.98[1]
Cleveland	90.8	97.4
Chicago	91.0[1]	104.3
Detroit	96.8	100.7
Boston	96.8	114.86
Baltimore	97.0	147.7
Buffalo	109.85	121.54
Pittsburgh	115.3	122.5

[1] Estimated only.

TABLE No. 34.—INFANT MORTALITY STATISTICS FOR THE FIVE BOROUGHS OF NEW YORK CITY.

Boroughs.	1919.	1918.
Bronx	73.9	77.3
Brooklyn	77.4	90.4
Queens	79.7	92.9
Manhattan	87.2	96.1
Richmond	87.6	105.0

TABLE No. 35.—INFANT MORTALITY STATISTICS RECEIVED FROM THE HEALTH DEPARTMENTS OF THE TEN LARGEST CITIES IN THE UNITED STATES.

1920.

City.	Rate.[1]	Births.	Deaths.
Los Angeles	70.8	11,652	825
New York	85.4	132,856	11,340
Cleveland	86.	19,804	1,702
Philadelphia	88.57	43,547	3,857
Boston	100.8	19,494	1,966
Detroit	104.2	27,636	2,880
Baltimore	104.2	18,808	1,960
Pittsburgh	110.1	14,694	1,619

[1] Per 1000.

The prognosis depends on the above conditions. The disease is chronic and may cause death.

Treatment.—Such cases do well by having a change of air. These children should not be permitted to attend school, and the same applies to the workshop, if the child is working. Sea bathing and cold sponging of the body, followed by friction, is very beneficial. A rigid liquid diet, consisting of peptonized milk, Zoolak, soup, broth, and strained gruel, with an occasional change to cocoa, should be allowed. Fruit may also be permitted. This treatment must usually be carried out for months before recovery may be expected.

IV.

DISEASES OF THE INTESTINES.

INSOLATION (HEAT-STROKE; SUNSTROKE).

THIS condition is most frequently seen in midsummer. It sometimes occurs in perfectly healthy children who are exposed to the direct rays of the midday sun. I have frequently seen cases of sunstroke in *feeble children* who were playing in the shade. Children with lowered vitality and convalescents from some severe illness, such as diphtheria or pneumonia, are more prone to be affected by intense summer heat.

Pathology.—Intense cerebral hyperemia and an intense engorgement of the veins throughout the body are the usual lesions seen in this condition.

Symptoms.—A child in apparently good health in midsummer will suddenly show intense fever. The temperature reaches as high as 104° or 105° F. in many instances. There is a corresponding increase in the pulse-rate. The pulse may be as high as 160 or 180. The face is usually flushed. The head is hot. There is a very apparent throbbing. The child may be unconscious and muscular twitchings may be noticed. In severe prostration there may be delirium and convulsions.

The pupils are usually contracted, although they may be dilated, and the eyes intensely congested. Sometimes vomiting and diarrhea may accompany the symptoms above mentioned.

The following illustrates the manner in which heat-stroke occurs:—

A child will awaken in a normal condition, eat its breakfast and play as usual. After several hours' hard playing and exposure to the sun's rays, the child will be exhausted. If a careless mother or nurse permits the child to continue its exposure to the direct midsummer heat, then prostration with the above-noted symptoms will be noticed. In some cases brought to my clinic, the head is hot and the hands and feet are cold. If the sunstroke takes place soon after feeding, then violent gastric symptoms usually occur.

Prognosis.—The prognosis depends upon the vitality at the time of sunstroke. We must differentiate this condition from meningitis. The suddenness of the attack following exposure to the sun will usually aid in making a diagnosis. The majority of cases seen by me recovered. Occasionally a fatal case was encountered, especially in bottle-fed infants.

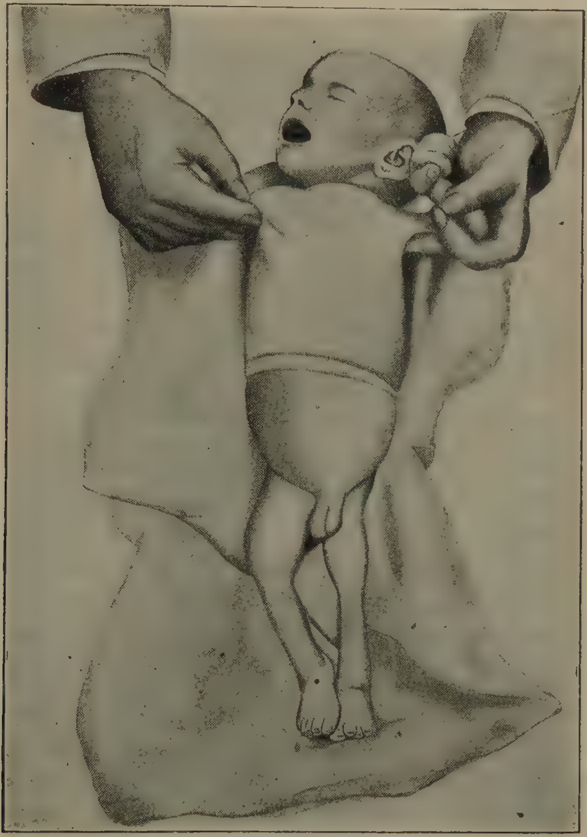

Fig. 65.—Insolation (heat-stroke). Type of midsummer cases in New York City.

This infant (Fig. 65), brought to my clinic, weighed 5 pounds 6 ounces. He was a bottle-fed infant, reared on condensed milk. He was 9 weeks old. Vomited after each feeding, had greenish, mucous, sour-smelling stools, every half-hour and oftener. There was eczema between the thighs from excoriation and acid stools. The child weighed 6½ pounds at birth, and was a full-term baby.

The child was pulseless. The extremities were cold and covered with a clammy perspiration. The temperature was subnormal—97° F. The fontanel was depressed. The heart sounds were barely audible. The mouth, tongue, and lips were very dry; food and water were refused. Spirits of camphor, 5 drops, was injected hypodermically; a mustard foot-bath was ordered. The child died fifteen minutes later.

Diagnosis.—Cholera infantum, marasmus, due to malassimilation of food, and incorrect feeding. Extreme heat caused heart-failure and general prostration.

Treatment.—A tub-bath, temperature 90° F., gradually decreased to 70° F., duration five minutes, is advisable. An ice-bag should be applied to the head. If consciousness has been restored, the child should be allowed to rest; if not, then we can restore the circulation and relieve cerebral hyperemia by giving a mustard foot-bath for several minutes until the skin is reddened. The rectum and colon should be flushed with a hot saline solution at a temperature of 105° F.; this will stimulate diuresis besides cleansing the bowel. One-drop doses of aromatic spirits of ammonia with water may be given every fifteen minutes.

If the child can swallow then:—

℞ Bromide of sodium	10 grains.
Chloral hydrate	3 grains.

should be given to a child 5 years old. This can be repeated every hour until a sedative effect is produced. In some cases (comatose) it may be advisable to inject per rectum:—

℞ Bromide of sodium	15 grains.
Starch water	1 ounce.

Cold water should be given by mouth, with several drops of diluted hydrochloric acid. Peptonized milk, thin soups, and broths may be given every few hours. Liquid peptonoids can be tried if food is rejected.

DYSENTERY (ILEO-COLITIS).

The lower portion of the intestine is frequently the seat of an infection by pathogenic bacteria.

Pathology.—As this condition frequently follows severe milk infection, the pathogenic lesions are necessarily the same, although in a more aggravated form. In addition to the hyperemia of the mucous membrane there may be a small hemorrhage in the mucosa or submucosa. The mucous membrane is very deeply pigmented, frequently being of a purplish line. The solitary lymph follicles along the colon are swollen. The discharge of mucus is tinged with blood, and not infrequently the ameba coli described by Lösch, or known as the *ameba dysenteriæ*, described by Councilman and Lafleur, can be found. It is a unicellular, protoplasmic, motile organism from 10 to 20 micromillimeters in diameter, and consists of a clear outer zone (ectosarc) and a granular inner zone (endosarc), containing a nucleus and one or more vacuoles. Multiple abscesses are frequently found. The ulcer first begins as a small papule, the upper part of which sloughs off, leaving a grayish-yellow ulcerating surface.

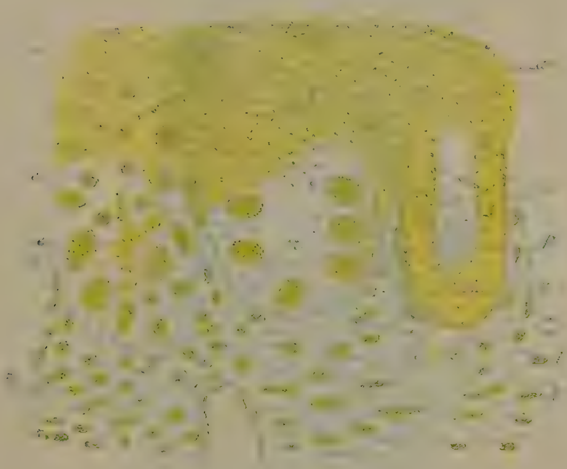

Fig. 66.—Bacillary diphtheria of the colon or diphtheritic colitis. *a*, Necrotic tissue containing bacilli. *b*, Gland with necrotic epithelium. *d*, Connective tissue. *e*, Degenerated and exfoliated epithelial cells. *f*, Bacilli in the lumen of the gland. *g*, Bacillary deposit beneath the epithelium. *h*, Nests of bacilli in the connective tissue. × 300. (*Ziegler.*)

Diphtheritic dysentery, sometimes known as the croupous variety, is a catarrhal form of this same condition previously described, in which the infection can be traced to an invasion of the Klebs-Löffler bacillus. The ulcerations are covered with a pseudo-membrane, and the pathogenic conditions are as previously described.

Bacteriology.[1]—There are two groups of bacilli which are responsible for the development of various types of epidemic dysentery:—

1. The true Shiga group.
2. Group of mannite fermenters.

The latter group is divided into two parts:—

(*a*) Fermenting mannite alone in peptone solution.
(*b*) Fermenting maltose and saccharose.

Symptoms.—The attack is usually ushered in with diarrhea. There is also considerable straining with each stool. At first the stools contain particles of feces, and as the disease progresses they become more liquid and contain mucus and blood. Some authors describe the stool as containing shreds that resembles the washings of raw meat. The face shows a very anxious expression. There is extreme pallor. The child appears prostrated. The pulse is accelerated and very feeble. The abdomen is distended, especially over the colon. Vomiting is a rare symptom. Unless treatment is rapidly instituted the child will fail in strength and may die. Such children usually sleep with the eyes half open and show evidences of collapse. The rectum may protrude, especially when there is a distinct relaxation of these parts. Cold, clammy perspiration is usually found, especially on the head. The extremities are cold. Convulsions appear in the severer forms of dysentery. In the diphtheritic variety the temperature and pulse resemble a case of true diphtheria. The stool, in addition to mucus and blood, may contain particles of pseudo-membrane. Toxemia can usually be seen by its effect on the heart and pulse. The urine may contain albumin. When the toxemia progresses, convulsions may set in and death result from cardiac paralysis.

Diagnosis.—The bloody mucus and watery stools seen in this condition, associated with tenesmus, will usually aid in eliminating acute milk infection. In gastro-enteritis and entero-colitis there is usually a greenish, spinach-like stool, or a brown, muddy stool having a very fetid odor. The stools in dysentery are smaller in quantity. Both the diphtheritic and the amebic forms of dysentery are rare in children.

Prognosis.—If this disease is epidemic, or if it occurs in children having bad sanitary surroundings, then the prognosis is bad. The duration of an acute attack is usually about five or six days. The prognosis is good when the diarrhea and blood gradually disappear. The main point to remember is that the heart must be sustained by proper nutrition, and we should try to counteract the toxemia by proper stimulation.

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[1] The Journal of Medical Research, vol. xi, No. 2.

Treatment.—The same hygienic measures described in the chapter on Food Intoxication apply equally as well here. Impress the mother or nurse that unless she carries out the directions minutely, the child has little chance of recovery.

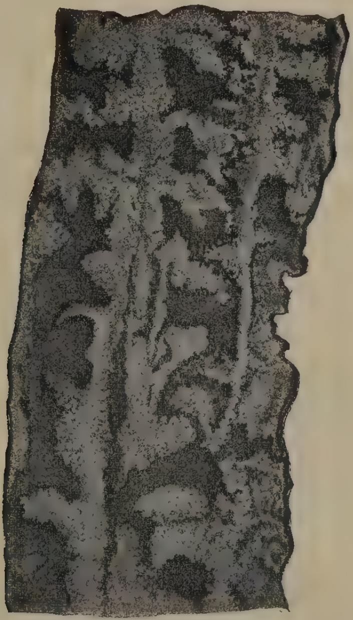

Fig. 67.—Croupous enteritis, diphtheritic colitis, two-thirds natural size. (*Langerhans.*)

A serum known as the antidysenteric serum will modify the toxemia in cases showing profound exhaustion. The serum should be injected every day in doses of 10 to 15 cubic centimeters. Good results have been seen by me with such treatment.

Dietetic Treatment.—Milk is contraindicated, hence all preparations of the same should be discontinued. The butter-flour broth, Czerny-Kleinschmid (See page-index), is nutritious and well taken by children. Mutton-barley broth, toast crumbs, weak tea and coffee to which the yolk of a raw egg is added is indicated. Arrowroot made into a pudding without milk, or cornstarch, is advised. Jell-o or calf's foot jelly is a cooling and nutritious form of food. To relieve thirst weak tea and barley water may be given.

Local Treatment.—The physician will be most successful who places his patient in bed, regulates the diet, cleanses the intestinal tract, and relieves the tenesmus by local treatment. The heart should be supported. The strength must be sustained with nutrition and the flushing of the bowel should be performed as soon as possible after a stool is evacuated.

Warm chamomile tea should be used to cleanse the colon and rectum. This should be injected at a temperature of 100° to 105° F., with the aid of a small rubber catheter. This can be followed by an injection of 1 ounce of sterile water containing 2 grains of nitrate of silver. Very bland injections, such as

℞ Raw starch	1 teaspoonful.
Chamomile tea	1 quart.
Laudanum	5 drops.

injected at a temperature of 100° F., will soothe the rectum and frequently relieve tenesmus. I have successfully treated dysentery cases with the following:—

℞ Argentum nitrate[1]	6 grains.
Cocoa butter	q. s.

M. Form into 12 suppositories.

℞ Oleoresin terebinthinæ	12 grains.
Extract of belladonna	6 grains.
Extract of opii aquosa	1 grain.
Cocoa butter	q. s.

M. Form into 12 suppositories.
Sig.: Insert alternately q. three hours.[2]

Sulpho-carbolate of soda, in doses of 5 to 10 grains, can be used several times a day. Bismuth combined with Dover's powder is frequently valuable. An ice-bag placed on the abdomen in the region of the colon will sometimes do good. Very cool injections of table salt and water are sometimes of value when hot injections are not well borne.

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[1] Argyria should always be remembered when prescribing nitrate of silver.

[2] As the nitrate of silver would oxidize the organic matter contained in the second formula, the suppositories must be given at intervals of three hours.

PELLAGRA.

The etiology of pellagra is still obscure. Jos. Goldberger,[1] in an extensive study of this subject for our government, found that, first, this disease is essentially rural; second, associated with poverty. While positive data are not available as to the real etiological factor, be it insect transmission or diet, the impression prevails that canned goods, vegetables, and cereals, especially corn products, should be laid aside, and fresh milk, fresh eggs, and fresh meats used instead. In a study of an orphanage at Jackson, Miss., of 211 orphans, 68, or 32 per cent., had pellagra. Practically all of the cases were children between the ages of 6 and 12 years. In a group of 25 children examined, under 6 years of age, there were 2 cases. In a group of 66 cases over 12 years of age, there was 1 case.

The exempt group were found to subsist on a better diet than the affected group. In the diet of those developing pellagra, a small amount of meat and other animal protein food was found. A large part of the ration consisted of corn syrup, and legumes. The inference may therefore be safely drawn, that pellagra is not an infection, but that it is a disease essentially of dietary origin. It may be caused, for example, by the absence from the diet of essential vitamines. Meyer and Voegtlin believe that the presence, in the vegetable food component, of excessive amounts of soluble aluminum salts is responsible for this disease.

Symptoms.—The skin manifestations may either be a slight roughening or thickening of the affected skin, so that an urticarial or erythematous flush resembling erysipelas may be found. Other types are either edematous or have an extensive desquamative dermatitis. In fatal cases marked sloughing of the skin is noted. Glossitis and stomatitis are common symptoms. The bowel disturbance is usually diarrheal in character. Now and then a case will appear in which constipation exists.

Lorenz[2] has made a study of the cerebrospinal fluid in pellagra. He finds that:—

1. A lymphocytosis of the cerebrospinal fluid does not occur in uncomplicated pellagra.

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[1] Goldberger: The Treatment of Pellagra. Reprint No. 218 from the Public Health Reports, September 11, 1914.

[2] Lorenz, W. F.: United States Public Health Service, and director Wisconsin Psychiatric Institute.

2. Globulin excess of the spinal fluid is only occasionally observed.

3. Lange's colloidal gold chloride test is uniformly negative in pellagra.

4. The Wassermann is negative with a few exceptions. In this investigation the exceptions were moribund cases which gave weakly positive reactions with blood-serum.

5. The spinal-fluid findings would seem inconsistent with a conception that pellagra is an infectious disease of the central nervous system.

It is very evident from Lorenz's examination that we are dealing with some local disturbing agent in which the gastro-intestinal canal is the part affected. When one considers that the bulk of cases appear in those districts in which the food is largely made up of preserved, canned, and desiccated or packed meats, then the diet must be looked upon as probably responsible for the symptoms noted.

Treatment.—Treatment consists in reducing the food that probably causes the disease, and adding fresh meat, milk, eggs, and legumes to the diet. The diet advised in the treatment of scurvy is similar to that advised in the treatment of this condition. Arsenic, atoxyl and salvarsan have been recommended, but one and all have been found wanting. Small doses of quinine, iron and strychnine, codliver oil, olive oil, fresh butter and fresh cream will aid in restoring normal conditions. To relieve the diarrhea a dose of castor oil followed by 5- to 10-grain doses of bismuth or tannigen should be given.

NUTRITIONAL DISTURBANCES.

Weight Disturbance (Mild).—There are four clinical conditions, according to Finkelstein's classification, in which disorders of nutrition and faulty metabolism occur. First is the mildest form of intestinal disturbance in which we find weight fluctuations. In spite of the food being sufficient in quantity, there is no regular gain in weight. In addition to the fluctuation of weight, the temperature varies, the appetite is poor, and the food tolerance is lessened.

When a very rich cream mixture with high fat content is given, the excess of fat acts as an irritant and causes the symptoms of fat indigestion. These are chiefly soap stools and an increased ammonia output in the urine. Unless this condition is corrected by lowering the percentage of fat, symptoms pointing to disturbance in the digestive tract will appear.

Dyspepsia (Moderate).—In dyspepsia, the moderate form of weight disturbance, we have thin, greenish stools containing mucus. The loss in weight may not be marked. There may be vomiting and a slight elevation in temperature. Constipation, obstinate and difficult to relieve, exists. As the condition is caused by excessive fat-feeding, the treatment consists in reducing the fat, and giving malt-sugar or malt extract to overcome the constipation. Restorative treatment, chiefly fresh air, or change of air if possible, will aid in stimulating this faulty metabolism.

The prime cause of dyspepsia is overfeeding. The great tendency to have large gains in weight has led many to prescribe high fats and excessive quantities of carbohydrate, chiefly sugar. This excess of sugar will in time give rise to symptoms of vomiting and grass-green, diarrheal stools. The abdomen is distended and there is a slight rise in temperature, usually between 100° and 101° F. The excessive sugar feeding usually results in eczema of the face or scalp. There is marked irritation and erythematous redness around the anus. The tolerance for food is greatly reduced. Finkelstein believes that when the fat content of the food is high the excess of fat causes the lowering of the tolerance for sugar. The condition is frequently found in infants fed on condensed milk. Herein we have a distinct sugar disturbance, colic due to excessive fermentation, and flatulence. If this condition is neglected and the food elements not corrected, serious results will follow.

An infant 3 months old, gaining in weight, with yellow stools, was suddenly deprived of its mother's milk and weaned. It was fed on cows' milk, 3 ounces; sterile water, 3 ounces; and malt-sugar, ½ teaspoonful, every three hours. After three days, vomiting, curded stools, and flatulence were noted. The diagnosis of dyspepsia was made. The formula was changed to skimmed milk, 3 ounces; sterile water, 3 ounces; and malt-sugar, ½ teaspoonful. The symptoms appeared milder, but continued until the sugar was stopped, and equal parts of sterile water and skimmed milk were given. After one week ½ teaspoonful of Loefflund's malt extract was added to every other feeding. In two weeks the formula was increased to skimmed milk, 4 ounces, sterile water, 3 ounces and malt-sugar, ½ teaspoonful.

The third stage of nutritional disturbance is decomposition (severe), in which the most important symptom of malnutrition is atrophy.

The fourth stage of nutritional disturbance is called intoxication. Finkelstein proves that it is not the bacteria, but a failure of metabolism caused by an excess of sugar, and that milk-sugar can of itself produce this intoxication. The removal of sugar from the food is followed by a cessation of all symptoms. This condition is described elsewhere in detail.

INFANTILE ATROPHY; MARASMUS, DECOMPOSITION, OR WASTING DISEASE.

If the symptoms of dyspepsia are prolonged there is a marked decrease in weight. In addition thereto there is a marked disturbance of the thermic center, and the previous febrile temperature gives place to a subnormal temperature. The pulse is slow, the respiration irregular, and the food tolerance is greatly reduced. The gravity of this condition must be apparent because of the constant loss of weight.

The condition is met with as a result of malassimilation of food. It is really a deficient metabolism, and results in a gradual decline. It is important to note that constitutional disorders, such as tuberculosis or syphilis, are not the causative factors. The Pirquet test should be made to differentiate this condition from tuberculosis.

Etiology.—The condition is caused by improper feeding, such as too frequent feeding of high-fat formulæ. By far the greater number of cases of atrophy are found in bottle-fed infants. An occasional case may occur as the result of faulty human-milk feeding. If we meet with a case of atrophy in a breast-fed infant, the thing to do is to have a chemical examination made of the breast-milk. If it is found deficient in quality, we must withdraw it and substitute bottle-feeding. If we wish to discard the mother's milk for some reason, it is advisable to secure a wet-nurse. The removal of such cases from the breast to the bottle or from the bottle to the human breast may be necessary to save life.

The true pathology seems to be a failure to assimilate food in infants with improper hygiene, and as a result progressive emaciation takes place.

Symptoms.—When infants suffer with vomiting or diarrhea, and this condition is allowed to become chronic, then colic and flatulence, associated with constipation, supervene, and the result is a gastrointestinal catarrh. Neglect of this condition results in atrophy. The infant does not thrive, commences to waste, and unless we realize the seriousness of this condition, and give proper treatment, the infant will die from exhaustion and inanition. When these cases linger for months they develop rickets. Recovery without treatment is impossible.

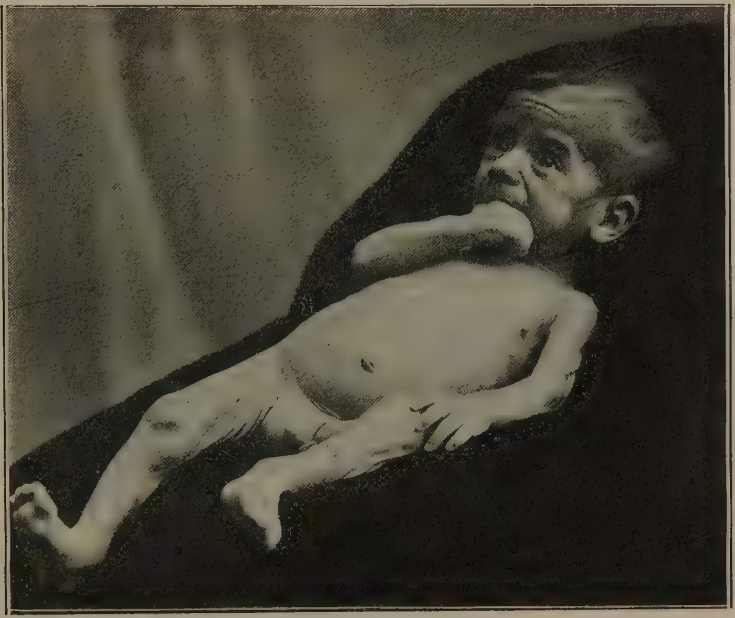

Fig. 68.—Decomposition. The loss of fat causes the skin to hang in loose folds. Note the left forearm and both legs. The forehead is wrinkled. The hand in the mouth is a characteristic symptom of hunger.

Prognosis.—The course of this condition depends on the amount of nutrition that can be assimilated. The worst forms of marasmic infants will frequently gain in weight when proper food is given. If the appetite is poor a decided change of air, from the city to the country, or *vice versâ*, will strengthen the infant and restore the appetite. Many an infant's life has been saved by a trip to the seashore or a sea voyage. The outcome of the case depends on judicious feeding, a change of air, and proper hygienic management.

Treatment.—If high-fat formulæ have caused this condition, the treatment consists in lowering the fat percentage of the food. Such cases will do well on skimmed milk. When skimmed milk is given, no sugar should be added. It is difficult to lay all blame on the cream, top-milk, or high-fat formulæ, especially if sugar has been added. In some cases omitting the sugar from the food will be sufficient; other cases require that both fat and sugar be discontinued for a number of weeks or until a tolerance for a small amount of fat and sugar has been established.

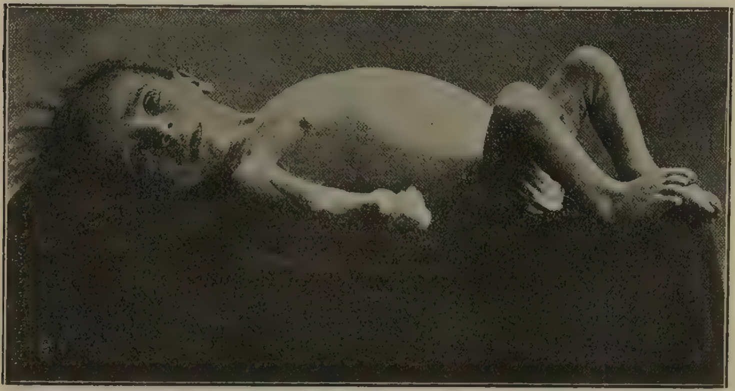

Fig. 69.—Infantile atrophy. The emaciation is seen on the neck, right arm, the thighs, and legs. The tendons on the right foot are plainly seen.

It is in this class of cases that the albumin milk or eiweiss milch of Finkelstein renders such good service. By feeding 6 to 8 ounces of this food every four hours for several weeks, the fetid odor of the stools will disappear and they will gradually assume normal conditions. During successful treatment with albumin milk we must not expect a gain in weight. As long as the fat and especially sugar is withheld we cannot expect a gain in weight.

Albumin milk is prepared as follows: A tablespoonful of Simon's essence of rennet (or 2 tablets of rennet) is added to 1 quart of milk, which is then placed in a water-bath at 107° F. for one-half hour. It is then filtered slowly by gravity without any pressure for about one hour through cheesecloth. The coagulum is then washed twice in 1 pint of water through a very fine sieve and forced through by means of a wooden spoon; then 1 pint of buttermilk is added. The chemical analysis of the food shows:—

	Albumin Milk	*Cows' Milk*
Protein	3.00	3.00
Fats	2.50	3.50
Carbohydrates	1.50	4.50
Ash	0.50	0.70

The theory as to the difficult digestibility of cows' milk casein is a thing of the past. Casein, as first shown by the teachings of the Breslau school, is readily digested, even by infants with serious digestive disorders.

The whey experiments have proven that the milk sugar in correlation with the whey salts are the primary disturbing factors, the ensuing abnormal milk-sugar fermentation causing faulty fat digestion.

The high percentage of casein, in correlation with the reduced whey salts and milk-sugar, counteracts the fermentative processes in the intestinal canal. Furthermore, it allows the feeding of a comparatively high percentage of fat. The carbohydrates should be increased by gradual addition of dextrimaltose.

Malt soup or dextrimaltose (Mead's) should be added in teaspoonful or more doses to each feeding until the point of carbohydrate tolerance is reached. The weight of an infant usually depends on its carbohydrate tolerance.

Spinach pulp, carrot pulp or baked potato with a little butter may be given by spoon with the milk formula. In malnutrition with stationary weight the vegetables are a great aid in stimulating metabolism and in regulating the bowels. They can be given once a day, after several days, twice a day.

Sugar intolerance is very frequently met with. Fat or cream intolerance is occasionally met with and will disappear when the cream or fat is reduced in quantity and when diluted milk is ordered. Milk being so important for the daily diet of a growing child, my advice is to go slowly before excluding milk from the dietary until the real cause for the milk idiosyncrasy or milk intolerance is found.

MILK INTOLERANCE.

Many infants cannot tolerate milk or even diluted milk. In some cases after partaking of milk infants will vomit, and have fever. Some infants will have a rash resembling urticaria or erythema which will clear up when milk is stopped. As a rule it is the lactalbumen which disagrees. Where milk intolerance is noted, buttermilk in which the casein is transferred into a casein lactate should be ordered. If the latter disagrees then vegetable proteins such as peas, served in form of broth, or the flour-butter soup (Czerny-Kleinschmid, page 120) should be used. In cases of milk intolerance the butter-flour formula is made with water without milk. Beginning with 3 or 4 ounces at one feeding, we can gradually increase the quantity until 6 to 8 ounces are fed at one meal. Many cases of supposed milk intolerance are caused by excessive sugar feeding. Sugar, be it maltose, sucrose or lactose frequently gives rise to gastric disturbances which will stop when sugar is excluded. Before excluding milk to which sugar has been added it is well to stop the sugar and see if milk alone agrees.

FOOD INTOXICATION (TOXICOSIS; CHOLERA INFANTUM; ACUTE MILK INFECTION).

For many years we have been taught that the ingestion of bacteria in milk causes diarrheal diseases. Some authors have found one or more million bacteria in 1 cubic centimeter of ordinary milk; other specimens have contained only 50 thousand bacteria in 1 cubic centimeter. In counting these bacteria, the harmless and harmful varieties are not separately considered. In other words, bacteriologists merely consider numbers. There are many forms of bacteria which normally inhabit the intestine. That these innocent bacteria assume a virulent form under certain irritated conditions has been suspected. The bacillus of Shiga has been found in many cases of intestinal catarrh with diarrhea and symptoms of intoxication. There are equally as many cases of the same type in which no Shiga bacillus can be found. One must assume, therefore, that there are other factors equally as important as bacteria causing this condition.

It has been possible to reduce one or more million bacteria in each cubic centimeter of raw milk to 50 thousand bacteria per cubic centimeter, by subjecting the milk to steaming at a temperature of 140° F. for ten minutes. We know that the toxins generated by some bacteria are more deadly in their action than the bacteria themselves.

To Finkelstein belongs the credit of having shown that bacteria do not enter into the causation of this disease, but that the faulty assimilation of fat and sugar is responsible for this condition. Finkelstein proves this by relieving the symptoms when fat and sugar are withdrawn from the food, and when the protein element is increased. This he does regardless of the presence or absence of bacteria.

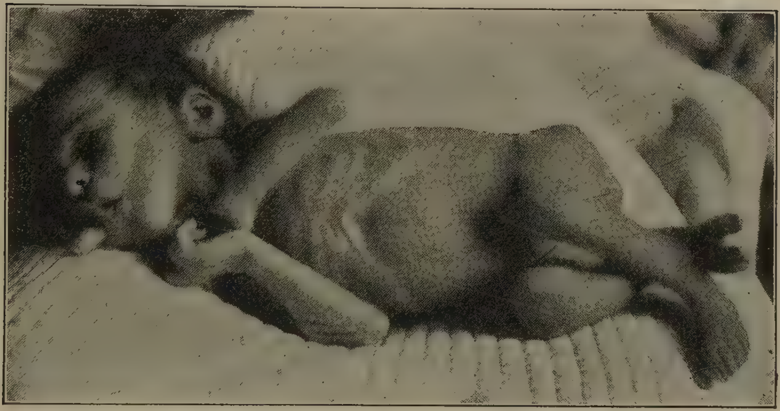

Fig. 70.—A case of acute milk poisoning having vomiting, diarrhea, mucous and bloody stools, general emaciation, acute cholera infantum, and dysentery.

In bottle-fed children, especially among the poorer classes, acute milk poisoning is frequently seen during the summer months. This is due mainly to the chemical or toxic products developed in the milk. The heat of the summer rapidly decomposes milk, and large quantities of bacteria multiply and generate their toxic products. When such milk is fed to infants they show the effect of the toxin very rapidly. Park found that when milk was first received from the farms it contained from 10,000 to 20,000 bacteria in each cubic centimeter. On the second day the bacteria had so increased that there were between 10,000,000 and 30,000,000 per cubic centimeter.

Summer diseases, particularly entero-colitis and cholera infantum, will appear just as readily in breast-fed children who are improperly managed as in bottle-fed children.

Pathology.—There is extreme emaciation of the entire body affecting muscle and fat. The fontanel is depressed. The eyes are sunken. The elasticity of the skin is gradually lost; the skin hangs in loose folds. The body resembles an advanced form of tuberculosis. Minute hemorrhages are found associated with intense congestion in the stomach and intestines. The evidence of catarrh is everywhere seen. There is an excessive secretion of mucus in the larger intestine; in the colon, ulcers will be found.

Ashby and Wright describe a general distention of the network of the capillaries situated in the mucous membrane of the intestine. The same condition is found in the submucosa, in the villi, and between the tubules and crypts of Lieberkühn. The central portions of the solitary glands are softened, or, the softened portions having been discharged, the remains of the glands appear as sharply cut ulcers, although the sinuses of the brain are found distended with blood. Occasionally cerebral anemia may exist. Meningitis is rare.

Bacteriology.—The enormous material at our command in this country gave the Rockefeller Institute an advantage in studying the pathogenic bacteria in this disease. It was found that the bacillus dysenteriæ (Flexner) is present in very many cases. Other investigators along the same lines have found the bacillus pyocyaneus (Cooper) a probable causative factor in this disease. On the other hand, Finkelstein, Escherich, and Moro believe that the bacillus acidophilus is the causative agent. Other investigators believe the bacillus coli communis or the streptococcus to be the causative agent. Finkelstein and Meyer have shown that milk sugar in food can alone produce intoxication. When a high fat content is present, this naturally aids in the intoxication caused by the sugar.

It is impossible to believe that bacteria *per se* are not at the root of the disease, and yet convincing argument is offered by the German investigators to prove their claim: That the disease is one in which there is a dietetic error resulting in, first a local and later a general, systemic disturbance.

The Spinal Fluid.—Nobecourt of Paris examined the spinal fluid of atrophic children in his hospital and found that there was a plus balance of the nitrogen in all cases, the greater the degree of atrophy the greater the percentage of nitrogen found in the spinal fluid. By increasing the carbohydrate in the food in proportion to the amount of nitrogen in the spinal fluid he was able to gradually reduce the plus balance until it became normal, when the baby began to gain in weight. In some of his cases he fed as high as 25 per cent. carbohydrate.

Some of the babies were bottle-fed and others were wet-nursed, in the cases that were wet-nursed the solution of carbohydrate was given during the breast feeding. In atrophy there is a disintegration of the cells and this breaking down of the cells is caused by the body requiring heat energy and the only source of supply is the body tissues which readily supply the required heat and energy. By giving a feeding high in carbohydrate you are giving a food that is rich in energy and heat giving material, by supplying this type of nourishing food the cells are spared and the consequent finding of a plus balance in the spinal fluid is eliminated. Sugars spare protein.

Causes.—The etiological factors can be briefly outlined as follows:

1. Food, improper quantity and quality of the same, be it breast-milk or hand-feeding.

2. The most frequent cause is certainly improper bottle-feeding, wherein food unsuited to the infant's digestive abilities is continued, in spite of Nature's efforts to warn us, as frequently manifested by either vomiting or diarrhea, or both.

3. Milk from mothers suffering with tuberculosis or syphilis. Pregnant, menstruating, and all anemic women secrete such poor milk that gastro-enteric derangements are exceedingly common.

4. The influence of the weather on digestion, especially the extreme heat of summer.

Harry G., 10 months old, bottle-fed, was brought to me with a history of vomiting, high fever, and diarrhea. The temperature was 104° F. The stool was green and contained mucus and curds, and had a very fetid odor. The stools were as frequent as twenty in twenty-four hours. There was a great deal of flatulence, the abdomen was distended, and there was constant tenesmus. The mouth was dry, the tongue had a whitish fur coating, and in the mouth small patches of stomatitis could be seen. The tongue protruded constantly and when liquids were given they were taken ravenously. The mother stated that ordinary grocer's milk had been used, and that she believed the milk had turned sour "after a thunder storm." The diagnosis of acute milk infection was made. The stomach was washed by the use of 1 quart of saline solution. Two drams of castor oil were ordered, and one hour later the rectum and colon were flushed with 1 quart of chamomile tea. All milk was stopped. No food was given for six hours. A bland diet of sweetened rice water and whey was then given in quantities of 4 ounces every two hours. As a stimulant, 15 drops of whiskey was given with 1/100 grain of strychnine every three hours. The child improved, and three days later 1 ounce of milk, with 7 ounces of rice water, was given every three hours. The milk was gradually increased every other day, and the rice water decreased. The child recovered.

Symptoms.—The two cardinal symptoms are (*a*) vomiting, (*b*) diarrhea. In some instances the first evidence of this infection will be fever. The temperature may be as high as 103° to 105° F. There will be intense thirst. There is no appetite. The infant will refuse its bottle, and if forced to take it will immediately vomit. Bile, mucus, and sour-smelling curd form the bulk of the vomit. The abdomen is usually distended. There is a great deal of flatulence. The stool is watery and greenish in color, with a very foul odor. When the diarrhea continues for several days, the temperature may become subnormal and the infant's forehead may be covered with a cold, clammy perspiration. The extremities are usually cold, The child will sink very rapidly, owing to the amount of exhaustion. The body is constantly drained by the diarrhea. Unless the clinical picture is recognized and proper treatment instituted, the infant may sink into a coma and have convulsions, followed by death.

The following case illustrates acute milk poisoning in an infant less than 1 year old. The infant was bottle-fed and received the food daily, modified, from a milk laboratory. This food seemed to agree until the time of the present illness. The infant was vomiting and had greenish, mucous stools. There was severe tenesmus. The infant showed severe prostration and was apparently comatose. The fontanel was sunken. The pulse was very feeble. The circulation was poor and the extremities cold. As no food was retained, in addition to the amount of toxin in the circulation, the heart's action became weaker and weaker. It was very difficult to rouse this child. In spite of high saline colon injections, the child died of exhaustion associated with general toxemia.

Diagnosis.—The diagnosis of this condition is extremely easy. It is usually aided by the clinical history. The disease usually occurs in summer, although milk poisoning can take place during any time of the year.

Differential Diagnosis.—Sunstroke may sometimes be confounded with cholera infantum, but the continued diarrhea in cholera infantum, and its history, should aid in eliminating this conditon as a factor. Asiatic cholera shows symptoms similar to cholera infantum. The presence of the comma bacillus in the stools will establish the presence of Asiatic cholera.

An important point to remember is that very many diseases have symptoms resembling cholera infantum and must be carefully differentiated; for example, typhoid fever occurring in midsummer may simulate this disease and give rise to symptoms which greatly resemble cholera infantum. We occasionally see children having diarrhea, vomiting and fever in whom on palpation a tenderness in the ileo-cecal region can be felt. Such cases may have appendicitis and still show all the symptoms of cholera infantum.

The blood examination will aid in excluding the diagnosis of appendicitis. In the latter condition we have a marked leucocytosis and a high polynuclear percentage.

The prognosis depends on the infant, its surroundings and the amount of infection, and the length of illness. An infant having good vitality and being given a careful diet and stimulation with proper hygienic treatment certainly has more chance than one living amid poor surroundings with faulty hygiene.

Hygienic Treatment.—Before feeding is considered we must put the infant into the best possible surroundings, a clean room, clean linen, a clean bed; in fact, all sanitary conditions must be perfect. If possible the infant should be placed on the roof of a house in the city, or out-of-doors in the country, both day and night. To place a case out-of-doors during the day is not sufficient. *If sea air is obtainable, it is best to remove the child to the seashore, or at least insist on daily excursions.* Cold bathing, or bathing in cold or lukewarm water, to which some sea salt has been added, has proven beneficial.

Dietetic Treatment.[1]—Having cleansed the gastrointestinal tract with castor oil, ordinary milk should be stopped. Buttermilk or Bulgarian milk may be given. Six ounces of buttermilk, 2 drams of wheat flour and 2 drams of granuated sugar should be mixed and brought to the boil, cooled and boiled a second time, cooled and given a third boiling. Six ounces of this mixture can be fed every three hours, or casac or larosan milk. Steamed rice or steamed barley, weak tea, toast scalded with hot water and cream cheese are the only foods permitted. Drinking water should be restricted.

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[1] Eiweiss milk is the best form of treatment. (See page 72.)

Casein calcium,[1] a white powder composed of 97 per cent. of casein and 3 per cent. of calcium, is an efficient substitute for eiweiss milch.

To prepare this food we take ⅓ milk and ⅔ water for infants under 4 months. Mix ⅔ ounces of casein calcium with 4 ounces of cold milk, bring 8 ounces of milk to a boil, then add the casein calcium and boil for five to ten minutes, stirring constantly. Strain and add 20 ounces boiled water. No sugar is added to the formula.

This is an excellent form of food and is one of the few preparations of modified milk which can be used in the treatment of catarrhal stools in infancy.

Exhaustion and death usually result from the dehydration of the tissues. Hypodermoclysis by injecting 4 ounces of normal saline solution into the cellular tissues of the abdomen or between the shoulder blades is advisable. This may be repeated every three hours. The intravenous injection (preferably the longitudinal sinus in infancy) of a 5 per cent. bicarbonate of soda solution, beginning with 2 ounces and increasing the injection until 4 ounces are given. The injection should be repeated every four hours at a temperature of 102° F.

Desperate cases of collapse have responded to this treatment. Infants in a moribund condition—almost pulseless will respond if such treatment is continued.

If the infant is breast-fed discontinue the breast at least twenty-four hours. If the acute symptoms of vomiting and diarrhea have been stopped by appropriate treatment, then the breast may be permitted once every six or eight hours, the alternate feeding to consist of rice or barley water sweetened with saccharine. In other words, we must return gradually to milk feeding. If acute symptoms return when the breast-milk is given, then it is a question as to whether or no the breast should be entirely withheld.

Antipyretic Measures.—Cold applications to the head and an ice-bag over the fontanel, cold towels changed every fifteen or thirty minutes over the abdomen, will tone up the nervous system in addition to reducing the temperature. I am a decided opponent to antipyretic drugs, and never use antipyrin or phenacetine, but invariably resort to hydropathic measures for the reduction of the temperature. Sponging of the body with alcohol and water is very refreshing, besides a good antipyretic measure. If cyanosis and cold extremities exist, then it is wise to resort to hot mustard baths to stimulate the circulation.

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[1] Larosan preparation on the market known as Larosan, also one as Casac (Mead's). Protolac is another excellent preparation made by Dry Milk Company of New York.

Drug Treatment.—The tendency to constipation following a dose of castor-oil makes it a valuable remedy in all forms of diarrhea. Bismuth is the sovereign remedy; I have used the subcarbonate, subnitrate, salicylate, and betanaphthol bismuth, and find the latter an extremely valuable preparation. In doses of 2 to 5 grains every few hours, mixed with a little boiled water, it not only agrees very well with children, but seems to exert a healing effect in that form of bacillary diarrhea which is met with in the acute catarrhal gastro-enteritis.

Salol in doses of 1, 2, and 3 grains, for each year respectively, is another valuable remedy; so also is resorcin, in doses of 1/4 to 1 grain for a child 1 year old, three or four times a day. It is advisable not to add sugar for sweetening, but only glycerine, the latter, however, in very small quantities, as it has a tendency to loosen the bowels.

Tannalbin and tannigen in doses of from 1 to 10 grains seem to act well in some cases, poorly in others, but are well worth trying in those desperate cases in which we change the drugs, if they are ineffectual.

Hypodermic Medication.—In forms of collapse, where constant diarrhea has drained the system, it is a good plan when the extremities are cold to give hypodermic injections of 10 to 20 drops of whiskey. Sulphuric ether can also be administered hypodermically in the same dose as whiskey. An intravenous injection of 1 pint of normal saline solution containing a dram of adrenaline solution, 1:2000, may be given. Another valuable stimulant is musk; 2 to 3 drops of tincture of musk administered hypodermically every hour will frequently rouse the circulation.

When this form of treatment proves unsuccessful, and the condition of collapse continues, then a good plan is to resort to *hypodermoclysis.* This consists of introducing a long aspirating needle (previously sterilized by boiling) into the loose connective tissue of the abdomen, and allowing several ounces of the normal saline solution, containing about 7½ grains of table salt to a pint of water, temperature 100° F., to flow in subcutaneously. It is remarkable to note how much liquid can be introduced in this manner, and some of the most desperate cases of collapse will respond very rapidly. I have seen children who previous to this injection were pulseless suddenly brighten up, and within a few minutes show a distinct radial pulse. Too much care cannot be bestowed on the sterilization of every part of the apparatus, and the absolute cleanliness of the water to be used for this purpose.

Rectal and Colon Flushing.—It is advisable to irrigate the colon and rectum by placing the child on its left side, introducing a flexible rubber tube *anointed* with carbolized vaseline. Having passed the external sphincter, I invariably allow the water to flow into the rectum in order to balloon the same, and then continue to push the tube beyond the rectum into the colon. A little difficulty is sometimes encountered, owing to the spasmodic contraction of the muscles, but if we wait a short time, using a little patience, the tube can easily be pushed into the colon. The method pursued is the same as described previously in irrigating the stomach, excepting that we do not seek to syphon off the contents of the bowels, but rather allow a pint or a quart of the warm saline solution to flush the bowels, and in this manner wash away as much of the offending *débris* as exists within the bowels. I have frequently used cold water, but I find much greater benefit from the use of warm solution of the temperature of 105° F.

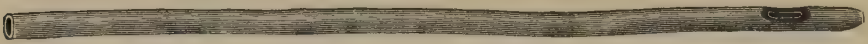

Fig. 71.—Exact size of catheter used for irrigating a very young infant.

Some of our cases require irrigation once in twenty-four hours for one week, and others again are so greatly improved after one rectal washing that it is not necessary to resort to it again.

Starch injections, made by adding 2 tablespoonfuls of the ordinary starch to a quart of warm water of a temperature of 105° F., may be given. They are very advantageous, as the colon changes starch into dextrin, which is easily absorbed. Thus not only does the latter cleanse, but it is also nutritious. Large quantities of saline solution can be introduced into the circulation by means of colon washing, thus adding to the volume of the blood. I therefore lay great stress on this form of treatment, as one of the most valuable for this depleting condition. Thromboses can frequently be avoided by these injections.

When severe tenesmus exists, painting of the lower end of the rectum with a 2 per cent. solution of novocaine is frequently very advantageous. Prolapse of the rectum and anus can frequently be prevented by applying a strip of zinc oxide plaster from one buttock tightly to the other, so that the buttocks will support the bowel and mechanically prevent its protrusion.

SUMMER DIARRHEA.

In this condition we have a gastrointestinal disorder due to the toxins generated from the bacteria in milk. This usually occurs during the summer months. The symptoms are not so severe as those seen in the acute form of milk infection. It is usually met with among the poorer classes, who buy a cheap grade of milk which usually contains millions of bacteria. Vaughn, in a letter to me, stated that although it is possible to destroy all bacteria by repeated and continued sterilization, he found it impossible to destroy the toxins generated in milk even though the temperature was raised to 300° F.

The weeds eaten by cows in their summer pastures are responsible for many cases of gastrointestinal disease. Many of these weeds are poisonous and their toxins pass into the milk. In support of this theory Hauser gives the statistics of mortality in a number of districts in his experience, classifying them by the soil and the weeds that grow by preference on certain soils.

Bacteriology.—Bacteriological investigation of summer diarrhea commenced when Escherich, in 1886, published his work on the intestinal bacteria of infants and their relation to the physiology of digestion. Lesage, Hayem, and Baginsky contributed further researches, but the most important and exhaustive researches were made by Booker from 1886 to 1897. As the result of these he called attention to three principal forms of summer diarrhea, based on a correspondence of their clinical, anatomical, and bacteriological features: (1) dyspeptic or noninflammatory diarrhea, in which the obligatory milk-feces bacteria are found, chiefly the bacillus coli communis, the bacillus lactis aërogenes appearing in smaller numbers; (2) streptococcus gastro-enteritis, in which there is a general infection and ulceration of the intestine, with streptococci as the predominating forms, some bacilli being present as well; (3) bacillary gastroenteritis characterized by a general toxic condition with less intestinal inflammation, and the presence in the stool of several varieties of bacilli, the proteus vulgaris being the most common.

Escherich studied the streptococcus cases more closely and found the cocci numerous and in almost pure culture in the stools in acute, severe cases, while it was possible to isolate them from the urine and the blood during life and from the viscera after death. Clinically, the symptoms vary much in the mild and the severe cases; the stools may be watery and contain much pus and blood. Staphylococci have also been found in diarrheal stools, but much less frequently than streptococci. Later Escherich described cases of dysentery due to a virulent colon bacillus. Valagussa found a bacillus belonging to the colon group and identical with that isolated by Celli and Fiocca from cases in Italy and Egypt. Shiga, of Japan, described the bacillus dysenteriæ, an organism more nearly related to the typhoid than to the colon group, and Flexner found a similar bacillus in one form of acute dysentery studied in Manila. Both Celli and Escherich tried to identify the bacillus they described with that of Shiga. The bacillus pyocyaneus has also been found in the stools of cases of epidemic infantile dysentery. It is evident, then, that no specific bacterium of gastroenteritis has been found; there is one form in which the streptococcus is the predominating organism, and the bacillus dysenteriæ may possibly be proved to be the cause of epidemic dysentery both in children and in adults.

Pathology.—Inflammatory lesions and ulcerations can be seen in the colon. It is rare to find the duodenum and jejunum involved. The microscopical findings of the stool show numerous bacteria, epithelial cells, detritus, and occasionally blood. Sometimes particles of food are also seen.

Symptoms.—Vomiting and diarrhea as in the acute form are the main symptoms. If an infant has just recovered from an acute milk infection and is placed on milk feeding too soon, a relapse frequently occurs, which is a subacute infection. The stools are greenish and resemble those described in the acute form. There is a loss of appetite, a coated tongue, and the temperature ranges between 101° and 105° F.; at times the temperature may be normal or subnormal. The infant does not want to be disturbed, and is very irritable. The irritation and tenesmus accompanying this diarrhea usually cause the rectum to prolapse, and from the constant discharge of the bowel the anus and buttocks are excoriated. An eczematous eruption frequently is seen between the thighs. Local infection of the skin and lymphatics, by the presence of the pyogenic bacteria, sometimes causes furuncles.

Diagnosis.—This is usually made when the history and symptoms are carefully noted. It is much milder than cholera infantum. The temperature is lower, the vomiting less, and the prostration not so marked.

Jonah W., 7 months old, twin baby, bottle-fed, had been constipated since birth. There was a slight cough. The child had beaded ribs, craniotabes, and baldness of the occiput. Since one month he had vomiting and diarrhea. This had improved and disappeared entirely. The child was given milk, and ten days after the milk diet was commenced the symptoms of vomiting and diarrhea again appeared, but in a milder form. Several furuncles were found on his scalp. Owing to the intolerance of milk, whey was given in the same quantity and frequency as the milk was formerly given. Rice water, barley water, and thickened pea soup were allowed. Toast water was given for thirst. Cocoa was also given without milk. The cocoa was made with rice water, in the following proportions:—

℞ Cocoa	1 dram.
Rice water	8 ounces.
Saccharine	¼ grain.

Scald about five minutes.

A large dose of castor oil followed by a 2-grain dose of tannopine every two hours was given. A high saline injection, 1 quart, temperature 115° F., was ordered to cleanse the rectum and colon; also for its stimulating effect.

The diagnosis of subacute milk infection, congenital syphilis, and furunculosis was made. The case recovered.

Prognosis and Complications.—This depends on the condition of the child. If there is a complication such as nephritis present, then the prognosis is worse than if uncomplicated. If an infant can be *removed to the seashore from unsanitary surroundings* and proper food given, the prognosis is good.

Treatment.—*Dietetic Treatment:* The treatment of summer diarrhea consists in regulating the diet. The derangement of the gastrointestinal tract is usually due to dietetic mistake. If fever exists all milk should be stopped for at least two days.

Liquids such as lamb, mutton or chicken broth may be given, 4 to 6 ounces, every three hours, until the fever subsides. To quench thirst, weak tea, cooled and sweetened, may be given.

Older children may receive, in addition to the chicken or mutton broth, arrowroot or cornstarch pudding. These puddings are made by boiling for ten minutes the following: Skimmed milk 4 ounces, water 4 ounces, arrowroot or cornstarch 1 teaspoonful and granulated sugar ⅓ of a teaspoonful.

In substituting other forms of feeding, *pro tempore,* we invariably do so at the expense of body weight. It will always be noted that children deprived of milk will lose weight unless care is taken to substitute a proper nutritious food. The body will lose to such an extent that atrophy may frequently follow.

Formula for Weak Infants in Substitute Feeding.—When vomiting and diarrhea persist give either:—

Barley water	4 ounces.
Rice water	4 ounces.
Oatmeal water	4 ounces.

Or:—

Whey	4 ounces.

Feed every two or three hours. Add ½ yolk of egg to each feeding.

If fermentation exists—colic, greenish stools, and eructations—use saccharine, ½ grain, instead of sugar for sweetening.

The liquid culture of the Bulgarian bacillus generates lactic acid. This liquid culture has served me very well in acute enterocolitis, and especially to control fermentation and colic caused by intestinal toxic bacteria. The liquid culture in dram doses, repeated every three or four hours, is non-toxic. Older children may also have junket, cream cheese, albumin-water and expressed beef-juice.

Medicinal Treatment.—A dose of castor oil should be given at the beginning of the treatment, first to cleanse the gastrointestinal tract, and secondly, for its constipating after-effect. Rhubarb and soda mixture in doses of ½ teaspoonful is valuable after the castor oil has been given. The treatment described in the article on Intoxication should be carried out as well in this condition. The successful outcome of the case depends on proper rest, careful stimulation, and a thorough cleansing, aided by a decided change of air, to the seashore or to the mountains. Milk should not be given until all conditions appear normal.

CONSTIPATION AND CHRONIC CONSTIPATION.

The bowels of an infant during the nursing period should have one or two evacuations daily. Some children will be quite normal with one evacuation daily. Older children who partake of solid food suffer more frequently with constipation. There are decided peculiarities noted in children with reference to the movements of the bowels. One child will enjoy good health, have a good appetite, and will gain in weight with three or four movements of the bowels daily. Another child in equally good health will have but one movement daily. These differences or peculiarities must be taken into consideration before definitely maintaining that our patient is really constipated.

The colon ascendens being very short, the surplus of length, particularly as the transverse colon also is not long, belongs to the descending colon, and especially to the sigmoid flexure. Drandt found it between 8 and 24 centimeters in length, averaging from 14 to 20 centimeters. Jacobi saw a case in which it was 30 centimeters long.

As the pelvis is very narrow, the great length of the lower part of the large intestine is the cause of multiple flexures, instead of the single sigmoid flexure of the adult. Thus it is that, now and then, two or even three flexures are found, and to such an extent that one of them may be found to extend as far as the right side of the pelvis. Cruveilhier and Sappey speak of this position of the lower part of the intestine in the right side of the pelvis as an anomaly. Huguier finds it on the right side of the body in the majority of cases. Others only occasionally, although they admit the great length of the sigmoid flexure. In common with Huguier, who even proposes to operate for artificial anus in the right side, Jacobi found one of the flexures on the right side many times.

The great length of the large intestine and the multiplicity of its flexures are of great functional importance. At all events, they retard the movement of the intestinal content, facilitate the absorption of fluids, and thus the feces are rendered solid. When this length is developed to an unusual extent, constipation is the natural result.

Records of *post-mortem* observations made by T. C. Martin prove that the muscular development of the adult rectum and lower sigmoid is plainly apparent, and that a *deficient muscularity* is observable in the infant specimens. In the infant gut the intrinsic power of peristalsis is not present in that degree necessary to it as a competent expulsory factor.

The meso-peritoneum of these parts in the adult is, relatively, very considerably shorter than that in the infant. The adult gut is slightly tortuous; that of the infant is much angulated. Mobility and angulation of the infant gut conspire to obstruct the passage of formed feces.

The rectal valve appears to bear the same proportion to the gut in both adult and infant, but when the difference in muscular development in the two is noticed the disproportionate great resistance of the valve in the infant rectum becomes an obvious fact.

Causes.—Dry, round and hard stools termed scybala may be the result of hepatic insufficiency, in which a decrease in the secretion of bile causes dryness of stool. Or, the intestinal glands do not secrete sufficiently to lubricate and aid peristaltic waves, and from this insufficient lubrication there is a stagnation of the intestinal contents. Such a condition may be due to structural weakness, as, for instance, in premature infants or in early rickets, in hereditary syphilis, and in atony due to improper diet.

In dyspeptic or rachitic infants the peptic and intestinal glands do not perform their normal functions; this absence of intestinal glandular secretions is one of the main factors in the causation of this condition. Incomplete peristalsis, such as exists in the rachitic debility of the muscular layer, in the muscular debility dependent upon sedentary habits and peritonitis, intestinal atrophy, and hydrocephalus, results in constipation. Boiling or sterilizing the milk fed to infants renders it constipating.

Symptoms.—Some children are in apparent good health; others show constant crying, with the legs drawn up; flatulence and a distended abdomen are the symptoms most frequently noted. A temperature of 102 to 104° F., may sometimes be caused by the stagnation of fecal matter in the intestinal tract. Loss of appetite, restlessness at night, may frequently be noted in such infants. In older children anorexia, headache, and stomachache will be described. Eructations and flatulence usually accompany constipation.

Diagnosis.—Before the diagnosis of constipation is made, we must be sure to exclude pyloric stenosis, intestinal obstruction, or incarcerated hernia as a possible cause for this condition. In

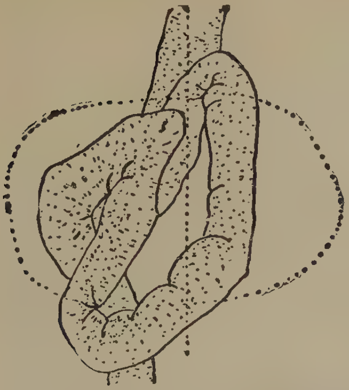

Fig. 72.—Ascending position.

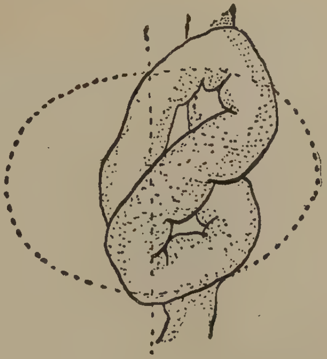

Fig. 73.—Ascending position.

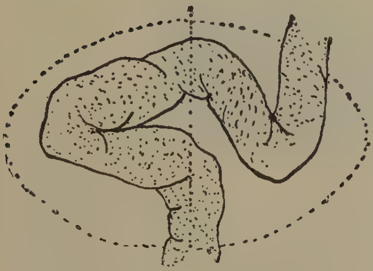

Fig. 74.—Transverse position.

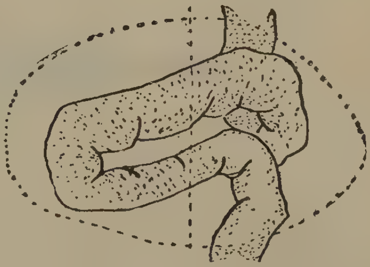

Fig. 75.—Transverse position.

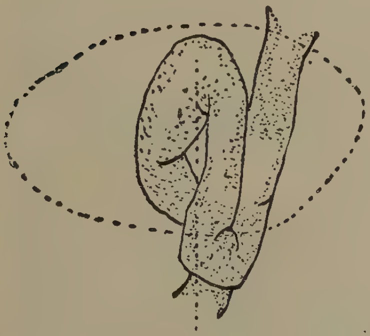

Fig. 76.—Descending position.

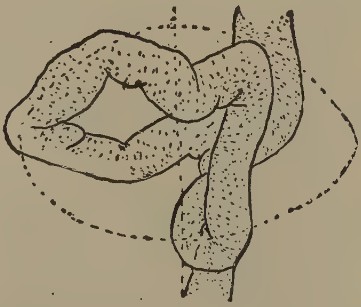

Fig. 77.—Descending position.

Illustrations of the various types of abnormality of the sigmoid flexure, which are the source of habitual constipation in infants. (After *Marfan* and *Neter*.)

like manner cystic tumors in the intestine may give rise to symptoms of constipation. We must also exclude the possibility of our dealing with a case of Hirschsprung's disease.

The diagnosis should not be made without bimanual examination. In most of the cases the abdomen is inflated, though it be painless. The feces come away in small, hard lumps or in large masses. The liver and spleen are displaced. The liver may be so turned that a part of its posterior surface comes forward. The abdominal veins are enlarged to such an extent that they form circles around the umbilicus, similar to what is seen in hepatic cirrhosis. These children lose their appetite, sometimes vomit, and the irritation produced by the hardened masses in the intestinal canal may be such as to finally result in diarrhea, which, however, is not always sufficient to empty the tract.

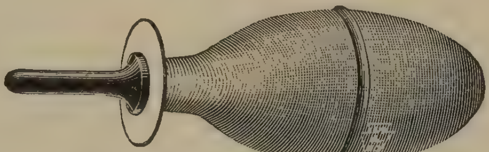

Fig. 78.—Rubber bulb syringe.

There is, besides, an apparent constipation, which should not be mistaken for any of the above varieties. Now and then a child will appear to be constipated, have a movement every two or three days, and at the same time the amount of feces discharged is very small. This apparent constipation is seen in very young infants rather than in those of more advanced age. Such children are emaciated, sometimes atrophic. They appear to be constipated because of lack of food, and not infrequently this apparent constipation is relieved by a sufficient amount of nourishment.

Treatment.—Our aim should be to modify the food, if the same is at fault. It must be remembered, however, that many factors may induce coprostasis; for example, deficiency in the tone of the intestinal muscles and insufficient peristaltic waves result in the stagnation of the intestinal contents. Deficient secretions of the intestinal glands favor constipation, so also a deficient secretion of bile.

The indications for the treatment of a given case of constipation depend upon the cause which leads thereto. If an atony of the gastrointestinal tract with deficient peristalsis exists, then stimulation by means of massage should be carried out. In addition thereto nux vomica in the form of tincture should be given in 1- or 2- drop doses three times a day.

For the immediate relief of constipation in an infant a glycerine or gluten suppository should be used. If this is not effectual, an injection of ½ pint castile-soap water should be given. When constipation persists, it may be necessary to give a soap-water injection every evening for many weeks. There is no danger in this procedure if it be continued for a short time.

When hard, dry, scybalous masses are passed and the infant strains considerably, it is advisable to inject 2 ounces of lukewarm sweet oil, with a small syringe, before the infant retires. If the buttocks are supported for several minutes after such injection, we favor the retention of the oil. Such oil injections will soften the hardened masses and favor their expulsion the following morning.

If constipation cannot be relieved by the simple methods above proposed, it may be necessary to use a catheter inserted between 6 and 8 inches into the colon. If we inject about 8 ounces of warm water and ½ teaspoonful of the inspissated ox-gall into the colon, we will have excellent results. Owing to the irritating nature of the ox-gall, its use should be restricted to fever, or when the child is very ill, and we aim at a rapid evacuation of the colon and rectum.

Drug Treatment.—Before attempting drug treatment we should carefully study the requirements of the infant, and try to modify the food so as to overcome the apparent constipation by food.

No one should expect to cure constipation by the use of drugs alone. There are so many factors which must be considered that drugs form but one part of the treatment.

When whole milk is given we should add milk-sugar (lactose) 1 teaspoonful to each 6 ounces of food. Likewise a teaspoonful of malt soup added to each feeding is laxative and nutritious. Nux vomica in 1-drop doses may be given three times a day as a general restorative, but must be continued for many weeks before results will be noted.

When rickets or intestinal atony exists considerable improvement both in appearance and nutrition, besides modifying constipation, can be secured by giving ½ teaspoon of pure codliver oil or olive oil three times a day. Aromatic albolene 1 dram in the morning, or Squibb's mineral oil 1 dram at bedtime, will relieve constipation. Orange-juice should be given regardless of the age of the infant. I have given orange-juice to infants one month old with excellent results as an antiscorbutic and laxative.

For older children, a teaspoonful of maltine with cascara sagrada taken in the morning, once only, is an excellent laxative. When a large quantity of starchy food is fed, resulting in an excess of acid, calcined magnesia should be given.

Dietetic Treatment.—For a very young infant, ½ teaspoonful of malt extract, or 1 teaspoonful of malt soup, may be added to each feeding. In estimating the required dose of malt soup it is important to supervise daily the frequency and character of the movements. Individual peculiarities must be considered. One infant will have an excellent result from 1 teaspoonful added to the morning feeding, whereas other infants will require the same dose added to every feeding. Milk of magnesia, 1 teaspoonful given in the morning, to bottle-fed infants, during the first half-year, is an excellent corrective. The method of heating the food, the source of the milk supply, and the quantity of water given the infant are all factors to be considered when dealing with an infant suffering from constipation. Instead of using plain water as a diluent of the food, use oatmeal water, if constipation persists. Sometimes diluting the milk with a 5 per cent. solution of sugar of milk will relieve this condition.

For infants over one year a small saucer of oatmeal porridge containing a dram of butter may be tried. A teaspoonful of sugar of milk may be added to one feeding.

In the chapter on Nutrition attention has been directed to the use of vegetables and vegetable juices in the modification of constipation. My experience with spinach pulp, 1 teaspoonful added to a feeding bottle once daily, has been very gratifying. Small particles of spinach will stimulate peristalsis and can be seen in the stool. Beet tops, lettuce and salad Romaine, cooked with a pinch of salt and finely chopped, then forced through a sieve, will aid in relieving the bowels.

We cannot expect specific action by the use of vegetable pulp after one trial. We must persist with these vegetable pulps many days, and give temporary relief to the bowels with a small quantity of tepid or cool soap water. If persisted in the spinach pulp added to the milk formula, or a small saucer of spinach pulp with thin butter sauce can be fed to an infant of nine months or older once daily, preferably at noon, with excellent effect on the bowels.

It must be remembered that bread, potato, macaroni, and most of the carbohydrate foods have a tendency to constipate. Prunes and senna leaves stewed to a jelly in sugar and water, apple sauce, oranges, grapes, and grape jelly all have a laxative tendency. When the casein of milk is altered by the Bulgarian bacillus into a casein lactate it has a laxative tendency. All fermented milks and buttermilk loosen the bowels. One or 2 ounces of fermented milks may be given; large quantities produce colic.

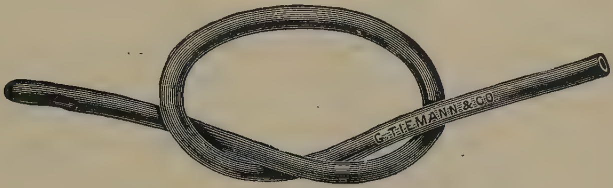
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Fig. 79.—Soft-rubber rectal tube for irrigating colon.

Exercise.—What massage is for a young infant, exercise is for an older child. Thus, it is apparent that atonic conditions can best be relieved by combating the dietetic and medicinal treatment with out-of-door exercise. Children should be permitted to romp about and walk and play out of doors, but not to a point of approaching fatigue. Older children will find bicycle exercise or horseback riding decidedly beneficial. It is important, however, to regulate the amount of such exercise, and thus it is the physician's duty to tell the mother or nurse just how *long a child should be permitted to exercise.* It would seem that one-half hour twice a day is ample to arrive at beneficial results. Overindulgence in such sports will frequently result in rupture and produce heart strain. In cardiac lesions, in asthmatic conditions, if children suffer with whooping-cough, and in tuberculous conditions, such exercise must not be allowed.

Massage.—Continued kneading of the abdomen with the aid of vaseline or oil will be found serviceable, and if properly done, will provoke an action of the bowel. Thus it is that rubbing the abdomen with castor oil has frequently been recommended in the treatment of constipation; the effect supposed to be due to the castor oil is, in reality, due to the massage, and to nothing else. When vibratory massage is used, it should be continued from from five to ten minutes every day for one month. This will certainly aid and stimulate peristalsis, and ultimately tone the muscles and cure the constipation.

The hands are gently placed on the right side of the abdomen at about the ileo-cecal region. Gentle pressure should be made; otherwise, the abdominal muscles will be tense. Commence each stroke of the massage with gentle pressure and utilize each inspiration for firmer and firmer pressure. The same method of palpation which is employed for the diagnosis of a tumor in the deep tissues should be employed. After firm pressure has been made, we can then gradually massage by a rotary movement, first, the ascending colon, continue over the transverse colon, and finally over the descending colon and rectum. Hardened scybala can frequently be felt in the region of the cecum and can be propelled by this mechanical treatment through the various portions of the colon to the rectum.

Massage from five to ten minutes morning and evening may be continued several weeks. If improvement is noted, then less frequent treatment is required. To be successful, several months of treatment may be necessary in obstinate cases. We must persist in stimulating the peristaltic waves regularly and not be disappointed if immediate results are not secured. My plan has always been to inform the parents that I do not expect any success in a chronic constipation which has persisted for months or years, until six months or more have passed.

Electricity.—This is very valuable to stimulate peristalsis. The faradic, galvanic, or static current can be used. For the general practitioner the use of the galvanic current, five to ten cells, is sufficient. The negative pole (cathode) should be applied in the rectum, and the positive pole, which produces peristaltic waves, should be applied over the ascending, descending, and transverse colon. Local contractions result from the negative pole. A gentle faradic current applied over the spine and the abdomen will answer if used for several minutes in the absence of the galvanic current. Galvanic electricity should be used every day; frequently months are required to insure a cure, in conjunction with the medical and dietetic treatment.

The Abuse of Cathartics and Laxatives.—The daily administration of laxatives and correctives to infants and children is a common practice amongst many mothers and nurses. This is well known to most physicians. Indiscriminate drugging to cleanse the intestine and empty the liver is a daily routine, and the abuse is founded on the enormous amount of advertising matter which convinces the laity of the necessity for so doing. This practice is so common that it is rare to hear of infants or children whose bowels functionate normally. Drugs and correctives are used to suit the whims or ideas of the person in charge of the infant. It is not an exaggeration to speak of this as an abuse of catharsis in children.

While the daily use of drugs may be required for a short time to stimulate the secretions and cleanse the gastrointestinal tract, it is unnecessary to continue this practice over a period of many months. In acute febrile manifestations or in toxic and septic conditions where sluggish or pseudo-paralytic functions exist, laxatives are indicated to eliminate stagnant residues and fermenting particles of food and their toxins. This is especially true in intestinal intoxications, accompanied by fever, caused by excessive fat or protein feeding. In this class of cases the subnormal condition caused by the fever demands especial attention.

It is our duty as physicians to sound a note of warning to the laity that the pernicious habit of giving a daily laxative lessens the functional activity and weakens the intestinal mucosa. This will in time result in a total loss of the peristaltic waves that coarse foods will stimulate if regularly fed. While we attain the object of cleansing and eliminating fecal particles we frequently interfere with the normal process of digestion and assimilation and deprive the system of nutrition intended for growth.

The daily use of a warm soap-water enema should also be condemned. While the enema will produce an evacuation by softening the fecal masses, the warm water relaxes the muscles of the intestines, and if persisted in will induce an atony of the intestines, with a tendency to prolapse. This I have seen in a few instances. When my advice is sought concerning the use of an enema, I advise water at a temperature of from 60° to 70°

F.—not more than a pint—usually ½ pint, at bed time or about one-half hour before the second morning feeding. This cold enema has a stimulating and tonic effect and does not produce a harmful result.

The habit of continually adding correctives to the infant's milk should be condemned. When large masses of tough, rubbery curds pass through the intestines undigested, due to excess of protein feeding, boiling the milk will soften the curd and frequently modify the constipation. The constipated stool caused by fat indigestion, known as calcium soap stool results from the formation of fatty acids in the stomach and intestines. When the foregoing condition exists the food must be modified, and not calomel and purgatives administered. When the food agrees and there is neither colic nor vomiting, but a gain in weight, my plan is to continue the formula, and if constipation exists, add an ounce of buttermilk whey to each feeding. Buttermilk whey is made by boiling the buttermilk and straining out the curd. One dram of the malted foods, or a dram of malt soup, added to each feeding will modify constipation.

The importance of water is not sufficiently emphasized. In giving a drink, not boiled water nor pasteurized water, but pure filtered cool wâter is required. Invariably on questioning mothers, they admit giving boiled water to their infants. I do not condemn the use of boiled water while travelling, or when using water of an unknown source. Fresh cool water will aid in eliminating food residue if given between meals. The water added to the infant's food is not sufficient. Water should be given as a drink between meals, several times a day. When water is refused it can be rendered more palatable by the addition of fruit juices, such as prune, orange or pineapple juice. Prune juice and spinach juice should be given for their vitamine content, their antiscorbutic properties, and their laxative tendency.

Diluents such as oatmeal water, barley water and other starchy gruels, while nutritious and valuable in modifying the casein and fat of a given formula, have not been successful in modifying constipation. Their value consists in adding more protein to the food, although flatulence and belching usually result.

The Older Child.—The mechanical stimulus, in the atonic gut, can be given to food by the addition of bran to cereals, or by the use of figs or raisins, whole wheat bread, and the coarse cereals such as oatmeal. Buttermilk or fermented milk can be used to thin the gruel.

To sweeten the food, as well as for the carbohydrate value, granulated sugar, milk sugar or malt sugar (dextri-maltose) or malt soup should be added to the milk. Vegetables such as chopped spinach or chopped string beans, the green vegetables rather than the starchy cereals such as potato, should be given. Crackers, wheat bread, biscuits, potato, and macaroni are the foods which should rarely be fed unless mixed with a diet having a laxative tendency.

Deficient peristalsis can be stimulated in older children by colon massage, gymnastics, and calisthenics. In some instances gentle faradization or the high frequency current applied in two-day intervals, will aid in stimulating the internal functions and in promoting peristalsis.

In subnormal nutrition where rachitic atony of the intestine exists there is no drug that will aid nutrition and modify constipation better than codliver oil. It must be given pure. To an infant six months of age, 3 drops may be added to milk, three times a day, and the dose increased until 10 drops are given three times a day. Codliver oil should be ordered regardless of the season. It is an antiscorbutic in summer as well as in winter.

Oil Injections.—Olive oil may be injected by means of a glass syringe with rubber tip attached. One-half ounce of oil injected into the rectum, or with the aid of a catheter, into the colon at bedtime will soften scybala. If left in the colon over night some of the oil will be absorbed. Oil injections should not be used oftener than every other night.

The well-known results of thyroid therapy in cretinism, and the specific action on the constipation accompanying this disease needs no emphasis. The administration of ¼ grain thyroid three times a day, gradually increased until 1 grain is given three times a day, has acted beneficially in quite a number of cases.

Interference with normal glandular activity and forcing peristalsis continuously for months, and in some instances for years will lead to intestinal atony and consequent coprostasis. We must distinguish between an acute febrile condition in which there is lessened functional activity of the intestinal muscularis and one in which there is deficient glandular secretion.

On the one hand we have an acute febrile manifestation in which therapeutic aid of one sort is required, whereas the condition of decreased secretion of the pancreas or intestine requires aid of another sort. The physician in charge of the case must exercise his judgment in determining the choice of the drug best suited to correct the individual case.

HIRSCHSPRUNG'S DISEASE (DILATATION OF THE COLON; MEGACOLON).

Dilatation of the colon and hypertrophy of the colon may be due to muscular weakness or a partial defect in the muscles of the lower portion of the large intestine. When such condition exists there is a stagnation of fecal matter, and we have the usual products of fermentation and decomposition. The latter will give rise to considerable flatulence and by reason of the muscular weakness of the intestinal walls there results a dilatation which remains permanent.

There are two prominent symptoms characteristic of this disease: First, obstinate constipation, in some cases extending over many days; second, extreme abdominal distention.

Some of these cases by reason of the stagnation of fecal matter will show loss of appetite, marked irritability, and insomnia. The urine usually contains indican.

The diagnosis depends on whether or not the condition can be traced back to early infancy. It is important to differentiate this disease from ovarian tumor, cirrhosis of the liver, or abdominal cysts. The prognosis may be grave if colitis ends in an ulcerative process.

The treatment consists in abdominal massage and mild, stimulating laxatives. It is important to correct the stagnation of fecal matter by daily injections of soap water. Surgical aid, such as resection of the intestine, may be demanded in the severer forms of the disease. An artificial anus has been suggested; this must be considered, however, as a temporary benefit only.

INTESTINAL COLIC (INTESTINAL NEURALGIA; ENTERALGIA).

Intestinal colic consists of pain which is paroxysmal in character, located in the bowel, and without evidence of inflammation.

Symptoms.—Colic is one of the most frequent causes of crying in children. They not only cry loudly, but will *suddenly shriek,* and when put to sleep will awaken with a sudden start, and cry loudly. The legs are usually flexed or they will move their legs back and forth, or up and down. They will seem to bend the body on itself. These attacks are usually associated with constipation; hence, it is a good plan, when the child is restless and utters a painful cry, to see if the bowels have moved. It is well known that this colic may be as well associated with diarrhea. The origin of all colic is certainly the feeding. When dyspeptic conditions, arising from undigested particles of food in the bowels, exist, then fermentation, resulting in gas formation, is the result.

Colic is frequently, but incorrectly, known by the terms of "meteorismus" or "tympanites," but in the latter conditions the abdomen is greatly distended, and there is a permanent enlargement of it. Borborygmus (rumbling sounds) can usually be made out, if the ear is applied to the abdomen. The vast majority of cases of colic have their seat in the intestine, and can be relieved very quickly.

Causes.—Worms (ascarides) have been known to cause colic. When there is a general loss of tone on the part of the muscular layers in the walls of the intestine, colic will frequently result. Colic can be caused by chronic peritonitis resulting in adhesions or local changes in the walls of the intestine that will produce local contractions or dilatations.

Excess of Sugar.—When colic is caused by an excess of sugar, there will be considerable eructations of gas, and, frequently, small quantities of food will be regurgitated.

The stools, when an excess of sugar is given, are thin and greenish, smell very acid, and usually produce a reddened excoriation of the buttocks around the anus.

When children show a tendency to the development of gas and have constant recurring colic, my plan is to discontinue the use of sugar until such time as this fermentation is absent. To sweeten the food I use small saccharine tablets, 1 grain being ample to sweeten 1 pint of food. When there is a tendency to constipation, it is possible not only to sweeten the food, but also to modify this constipation by adding a teaspoonful of malt-extract to each bottle. One-half teaspoonful of calcined magnesia added to each bottle of food will also relieve constipation.

Excess of Protein.—A careful observation of the stools would easily show whether the albuminoids are in excess, for they are usually present in the form of curds. This condition is usually associated with constipation, and the indication would be to cut down the quantity of protein administered.

Undigested curds due to excess of protein and excessive fats are a frequent cause of colic. Irregular feeding, too frequent or overfeeding, are the commoner causes. The majority of cases of colic are seen in bottle-fed babies.

When milk is boiled, the protein curds are thinned, smaller and more flocculent. Consequently the milk is more easily digested and less liable to cause colic.

Colic in Breast-fed Babies.—If colostrum continues and the milk does not assume normal conditions, colic may result. Colic is frequently seen during menstruation of nursing women. Pregnancy occurring during lactation may cause colic.

Differential Diagnosis.—We must be extremely careful to exclude the pain of intussusception, the pain from gall-stones, the pain of appendicitis, or the pain of a strangulated hernia. The absence of fever, the disappearance of the symptoms by the regulation of the diet, the flushing of the colon to remove the offending cheesy *débris,* will materially aid in strengthening the diagnosis. Sudden cry frequently denotes earache. In infants the ears should be examined in all febrile conditions.

Infant J., 11 months old, bottle-fed, cried and suffered with pain from one to two hours after taking his feeding. The temperature was 101° F., rarely higher. The infant would scream for a few minutes at a time, then expel flatus per rectum, and be apparently relieved. He would be cheerful and play for a short time, when another paroxysm of pain would come on and start him screaming again, until flatus was expelled. Relief was immediately given when the rectum and colon were flushed with warm water, temperature 103° F., to which several ounces of glycerine had been added. Antifermentatives, such as rhubarb and soda mixture, or several grains of calcined magnesia, invariably relieved the child and prevented intestinal fermentation.

The treatment of colic is simple when the cause is known. The quickest method of relieving colic is to give an enema of soap and water or of warm chamomile tea. Take an ounce of chamomile flowers and steep them in a quart of boiling water from ten to fifteen minutes, then strain. With the aid of a rectal tube allow 1 or 2 pints of chamomile tea at a temperature of 100° to 103° F. (no hotter) to flow slowly into the rectum and the colon. When the colon is thoroughly flushed with this warm tea, and emptied of its feces, it is usual for the attack of colic to cease. In addition to washing the colon, it is a good plan to apply a small bag of either chamomile flowers or slippery elm bark, or ground flaxseed meal. To do this, I make a bag of cheesecloth capable of holding from 1 to 2 ounces, and then fill it with one of the above-mentioned ingredients; sew the bag shut when filled, and heat it before applying to the abdomen. Several of these bags can be made and kept in readiness, so that they can be applied quickly. It is a good plan to have one heating on the stove while another is on the abdomen. These little bags are very soothing.

Massage.—During an attack of colic gentle massage with warm sweet oil or melted vaseline or lard will be very comforting to the child. The distended abdomen should then be thoroughly massaged until the gas is expelled and the warm applications applied.

Drug Treatment.—If the colic originated from a fermentative dyspepsia, then treatment must be directed to the stomach. For this purpose antifermentatives, like the mistura rhei et sodæ, should be given in doses of ½ to 1 teaspoonful, diluted with water, every two or three hours until there is a thorough evacuation. Five to 10 grains of bismuth or ½-grain doses of resorcin will also be found useful. Paregoric in doses of 10 to 15 drops should be administered to children of six months or older. It is understood that no physician will forget the danger of giving repeated doses of paregoric or permitting the same to be administered by incompetent persons not aware of the dangers of the drug habit. The author has not only seen distinct opium poisoning follow the use of paregoric, but has also had occasion to see the distinct opium habit in very young children. For an infant during the first few months, it is hardly safe to give more than 5 drops of paregoric, repeated in an hour if there is no relief. Another drug that has served me very well is Hoffmann's anodyne in doses of from 1 to 5 drops, repeated in an hour if necessary. For an infant up to two months, 1 drop per dose; from two to four months, 2 drops per dose; four to six months, 3 drops; six to nine months and until 1 year of age, 4 drops; children from 1 to 2 years, 5 drops. This is to be given in a teaspoonful of sterilized water. Another valuable drug, and one that is to be given cautiously, and in the same doses as Hoffmann's anodyne, is spirits of chloroform; never should more than from 1 to 4 drops be given to a child up to 1 year of age, and younger children less in proportion. I cannot favor the administration of nauseating or foul-smelling drugs, such as asafetida. We must try to cater to an infant's taste, especially so when in pain.

An excellent preparation to relieve colic is calcined magnesia, or milk of magnesia made by Phillips.[1] It has served the writer very well, especially in young infants, where acidity was prevalent. A half-teaspoonful several times a day was enough in some cases, while others required several teaspoonfuls during the day. It is valuable where constipation exists, and can be added to the bottle of food.

CHRONIC INTESTINAL INDIGESTION (DUODENAL CATARRH; MUCUS DISEASE).

This condition is always associated with a chronic derangement of the stomach. It is usually a functional disturbance and is one of the most difficult conditions to treat in children.

Etiology.—This is usually obscure, although it follows exhaustive diseases such as typhoid, diphtheria, or other infectious diseases. The most frequent cause is improper food, unsuited for the age and development of the child.

Symptoms.—As a rule, gastro-enteritis precedes this condition for months, in each and every case. The stool shows a tendency to looseness and mucus is found covering the feces. The mucus is seen in shreds and masses at times covering the fecal matter. Such children are usually backward in development. They are very irritable, tire easily, and lose in weight.

As a rule, the abdomen is distended. There is no fever. The appetite varies and is poor. The liver does not functionate properly, and in some cases very little bile is secreted, giving rise to claycolored stools. The skin is dry.

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[1] *Phillips's Milk of Magnesia—Hydrated Oxide of Magnesium* (MgH_2O_2).—A teaspoonful of Phillips's Milk of Magnesia is equivalent in acid-neutralizing power to 4 ounces of lime water, or 10 grains of sodium bicarbonate. It will neutralize nearly twice its volume of lemon juice. Each fluidounce represents 24 grains of magnesium hydrate. Dose: From a teaspoonful to a tablespoonful, according to age—increased or diminished at discretion. Dilute with equal quantity or more of water.

Diagnosis.—The only condition which might resemble chronic intestinal indigestion is general tuberculosis. The absence of cough, the absence of fever, and the absence of physical signs in the lungs should help to exclude tuberculosis. The diagnosis will be more readily made when previous gastric or gastrointestinal derangements are taken into account.

Prognosis.—This is usually good, even though these attacks may extend over years. If, however, rapid emaciation and general weakening of the heart exists, the prognosis becomes grave.

Treatment.—*Dietetic Treatment:* This is the most important part of the treatment and requires very careful consideration. Excessive fats and sugars should be avoided. Light meals rather than heavy should be ordered. Give predigested food if required. Whey, skimmed milk, Zoolak, thin cocoa, chicken broth, beef broth, clam broth, soft-boiled egg, fish, oysters, raw scraped steak, apple sauce, baked apple, to be varied with other well-stewed fruit, should be given. Avoid all fresh bread. Rusk (zwieback) may be given. Give all green vegetables in season. Avoid all heavy cakes, pies, and puddings. If this light diet is continued for several months great improvement will be noted. The ultimate cure will depend on restricting the diet to nutritious and very easily digested food.

Medicinal Treatment.—Give nux vomica, 1 to 3 drops, three times a day, before meals. Or:—

℞ Acid. hydrochlor. dilut. .... 1 ounce.
Five minims three times a day, after meals.

Pay careful attention to the bowels; give a laxative if necessary. If severe anemia exists then give:—

℞ Tr. ferri acet. æth. .... 1 ounce.
Ten drops, three times a day. One hour after meals.

This has been found to be the best form of iron in the management of this condition.

A girl, 8 years old, was breast-fed in infancy and appeared apparently healthy. Her dentition, walking, and talking normally developed about the end of the first year. During the second year she suffered with measles. When 4 years old she had an attack of acute milk poisoning, resulting in gastroenteritis. From this time on she had not been in good health. She complained of headaches, nausea, and anorexia. She had a foul breath, and was very anemic. She did not seem to thrive. The slightest imprudence in eating caused gastric symptoms. Her abdomen was large and gas was frequently expelled per rectum. She was always languid. The temperature was normal, the pulse-rate feeble; it usually ranged between 90 and 100. She did not sleep well, talked in her sleep and tossed about. Under a rigid diet, excluding pure milk, and giving diluted milk, whey, thin soups, soft-boiled eggs, and fruit, improvement was noted. The interval of feeding was restricted to five hours, so that the child was fed three times a day. A daily movement of the bowels was insisted upon. One-half teaspoonful of phosphate of soda in a teacup of warm water was given when the child was constipated. Five drops of acid hydrochloric dilute was given three times a day. The case improved and the child recovered.

APPENDICITIS.

Appendicitis is an inflammatory condition in and about the vermiform appendix. The size of the appendix varies in infancy. Ribbert gives 3.4 centimeters as the average length, whereas Tojts found the average length to be 5 centimeters. A characteristic of the appendix in infancy is the general richness in follicles. Fecal concretions are rarely found in the appendix of infants and young children; this may be due to the fluid diet. The appendix usually contained parasitic ova and mucus, besides undigested particles of food.

Position of Appendix in Infancy.—The appendix is situated higher than McBurney's point. No definite rule applies to the position during infancy. It may be found pointing downward into the pelvis, or it may be directly on the cecum in the right iliac fossa, or it may point upward. Cumston reports a case in which the tip reached the right lobe of the liver. The appendix has an anatomical similarity with the tonsils. Both are composed of lymphatic tissue, and are adjacent to cavities filled with bacteria. The appendix partakes of the inflammatory process of the structure with which it is intimately associated.

Bacteriology.—Macaigne and Cumston found that cultures of the bacterium coli obtained from stools of patients suffering with appendicitis were far more virulent than similar cultures from healthy subjects. The streptococcus in milder cases produces a serious catarrhal process. The bacillus coli is the commonest organism found in appendicitis, although the streptococcus is frequently associated with it.

Klecki[1] found that pathogenic bacteria of a most virulent type can penetrate the peritoneal cavity. This penetration is either during perforation or through the lymph spaces of the damaged intestinal walls. The bacteria penetrating into the mucosa and muscularis may produce rapid necrosis of the tissue elements, the occurrence of perforation depending upon the virulence of the organism present and to some extent the position of the appendix in which gangrene occurs. In infants and very young children inflammatory processes in the appendix tend to progress rapidly, that is to say, necrosis of the mucosa and muscularis occurs promptly, so that the bacteria reach the serosa quickly before protecting adhesions have had time to be thrown off. For this reason it was found that in 50 per cent. of cases of appendicitis in infants and young children extensive peritonitis developed, this being based on the combined statistics of Schüle, Rotter, Lenander, and Sonnenburg.

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[1] KLECKI: Annales de l'Institut Pasteur, vol. lix, p. 710.

Death is frequently caused by the toxic forms of appendicitis. the absorption of the bacterial toxins causes the body to be overwhelmed with this poison. A thrombophlebitis of the vessels of the mucosa takes place; the bacteria become attached to the thrombi, liquefy them, and thus enter into the general circulation, producing metastatic foci in distinct organs, such as the lungs, kidneys, and myocardium. Thick, inflammatory adhesions always denote a previous inflammatory process. In 1867 Willard Parker, in the *Medical Record*, stated that necrosis with rapid perforation of the appendix was quite frequently found in children. He was the first to call attention to this condition.

Pathology.—*Catarrhal Appendicitis:* In this form the walls of the appendix are found thickened and hyperemic. The lumen of the tube is filled with *débris* of inflammation. If this inflamed condition continues, the canal may become obliterated. The catarrhal stage frequently ends in resolution.

Ulcerative Appendicitis.—In this condition the process involves the muscular coat, because the mucous and submucous tissues have been destroyed. The ulcer frequently terminates in perforation.

Gangrenous Appendicitis.—In this condition, also known as intestinal appendicitis, rapid necrosis of all the coats of the intestine takes place. If a fecal concretion exists and the ulcer perforates, an infection of the peritoneal cavity takes place from the virulent bacteria. This is usually due to a thrombosis of the artery of the appendix by direct extension of the inflammatory process in the intestine. By this means the entire nutritive supply to the organ is shut off and a rapidly progressing partial or total necrosis results.

Suppuration frequently follows the serous exudation, and a localized abscess is formed. The danger of such an abscess consists in the perforation taking place and the escape of the pus into the peritoneal cavity, setting up a diffuse peritonitis.

Causes.—Injury to this region, exposure to extreme cold, and overindulgence in purgatives have been looked upon as causative factors. Whether foreign bodies, such as seeds or hair swallowed by mouth, will lodge in the appendix and cause this disease is doubted by many.

Cases of helminthic appendicitis have been reported in which oxyurides were found in the tip of the appendix. Pfaundler and Schlossman report a case in which a large number of ascarides were found.

Symptoms and Diagnosis.—Muscular rigidity cannot be depended upon as a symptom in children. Every young child resists an attempt to examine the abdomen. Cutaneous hyperesthesia is often significant of appendicular inflammation. A sharp pain is elicited when the skin is lightly touched.

Palpation of the appendix is always somewhat problematical. We may be deceived by loops of the intestine in that region, or by the psoas muscle. If the appendix is very superficial, and if it is distended by an empyema, then only can a positive diagnosis be made.

Pain in the right iliac fossa is rarely a prominent symptom in children. Some children complain of an acute pain, neuralgic in character, in the right thigh. An abscess may appear in the left iliac fossa or in both fossæ at the same time; the so-called left-side appendicitis is a left iliac abscess.

Subjective symptoms in children must always be carefully interpreted; fear will frequently prevent complaining when an operation or hospital has been spoken of. Localized abscess is not as frequent as a general peritonitis, nor can we make out a tumor as promptly in children as in adults.

Tense abdominal walls with distention more marked on the right side would lead us to suspect an inflammation in and around the appendix. The cecal region can be easily palpated in a child. If it is impossible to properly examine the abdomen and rectum, then an anesthetic should be given and a proper examination made.

Rectal examination is advisable in every case where an appendicitis is suspected, and where vomiting and diarrhea are marked. Palpable resistance may sometimes be made out in the right pelvis. If pus has formed, a tumor surrounding the rectum can be felt. The temperature may rise as high as 105° F. in some cases and remain as low as 101° in other cases. It is only at the beginning of an acute inflammatory appendicitis that we will have a rise in temperature. Septic cases will frequently show a normal temperature; therefore, the temperature must not be our guide as to the necessity for an operation. The pulse is a more positive guide as to the presence of an inflammatory process; it also offers a distinct indication for an operation. A septic appendix will show its presence by an increased pulse; thus, the pulse rate in an acute attack may vary between 90 and 100, but if resistance is poor the pulse rate may rise to 110, 120, or 130 beats per minute, and the prognosis is correspondingly bad in such a case.

Vomiting is an early symptom and one that occasions considerable discomfort. In mild forms of the disease vomiting generally subsides. When peritonitis complicates, vomiting usually recurs. Periodical attacks of vomiting, so-called cyclic vomiting, may be a symptom of chronic appendicitis, with interval attacks.

The Bowels.—It is difficult to say whether constipation or diarrhea more often accompanies these attacks. I have seen cases in which diarrhea continued throughout the whole attack, so that my suspicion concerning typhoid continued until the localized area of inflammation formed. Frequently the symptoms of typhoid are so well marked that it is well to bear in mind the possibility of this disease. In other cases constipation was noted during the whole course of the disease.

The diagnosis is usually not very difficult. A sudden pain localized in the right iliac fossa, associated with gastric or intestinal symptoms and fever, should render the diagnosis easy. I rely upon the examination of the blood as an important guide in determining the presence of pus in the system.

We must not mistake appendicitis for an abscess in the right ovary. The same can be differentiated by a careful vaginal examination. In young girls, where this is very difficult, an examination can be made with greater ease in the rectum. By means of bimanual palpation we can usually differentiate the same. Acute intestinal obstruction occurs frequently in young children.

When the obstruction is due to an intussusception, bloody discharges from the bowels are generally present. In intussusception the mass is found either in the median line or in the left side, whereas in appendicitis it occupies the right iliac fossa. When there is a strangulated gut due to a volvulus the pain is not localized. In this form of obstruction of the bowel there is usually stercoraceous vomiting.

Hip-joint disease and tuberculosis might possibly be mistaken for appendicitis. There are a great many cases in which a diagnosis will only be positive after the abdomen has been opened.

An important aid in the diagnosis is the examination of the blood. A marked increase in the leucocytes occurs in appendicitis, and there is a marked decrease, leucopenia, in typhoid fever.

Differential Leucocyte Count.—When the polynuclear percentage is 70 to 90, and there is a marked leucocytosis, we should suspect pus. This blood examination must be used to support the other symptoms indicating an empyema, an appendicitis, or a mastoiditis—in fact, any suppurative condition.

In studying the leucocytes by the daily blood examination there are certain positive indications. Steadily increasing leucocytosis shows that the child has good resistance, and hence operative interference offers a good prognosis. Steadily decreasing leucocytosis is an unfavorable symptom, showing that the child has a poor resistance to the infection. Great caution must be used before an operation is decided upon.

Course and Prognosis.—The prognosis depends on the time when treatment is commenced. *A mild case of appendicitis may resemble colic with a slight rise of temperature and pass off unnoticed.* If these attacks recur our suspicion should be aroused and the appendix removed. It is a good plan for the physician to call the surgeon in consultation when symptoms point to appendicitis. *Very young infants do not bear laparotomy* well, owing to the shock caused thereby, but if the surgeon operates *rapidly* shock is greatly lessened. Cases of appendicitis frequently assume a chronic course. Attacks may recur at intervals of weeks or months. If the diagnosis is positive, it is much wiser to operate during the intervals of health rather than run the risk of a fatal complication such as peritonitis.

Treatment.—First and foremost, absolute rest in bed. Until the diagnosis is positive, the diet should be restricted to strained soups, skimmed milk, and weak tea for thirst. All starchy food should be excluded; hence neither bread, cereals, nor potatoes should be permitted. The choice between hot-water bags and ice-bags depends on individual experience. An ice-bag is soothing to children. It is of importance to see that the bowels have an evacuation once or twice in each twenty-four hours. While it is desirable to have an evacuation, no active catharsis should be prescribed. Do not stir up the abdomen with drugs, as it will positively do harm. To relieve the constipation, an enema of 1 pint of soap water and 1 ounce of glycerine will evacuate the stagnant feces. This enema may be repeated daily until the acute attack has subsided. If vomiting persists cracked ice may be given. The value of opium is disputed by many. It certainly relieves pain, but prevents peristalsis. My choice has been codeine, 1/10 grain, increased to 1/6 grain, repeated every hour, depending on the age of the child, until the pain was relieved.

If the symptoms continue in spite of the above treatment, it is possible that medical treatment is insufficient. No time should be lost, but prompt surgical relief should be given.

The Time to Operate.—If a child has had a series of attacks of appendicitis, then it is well to operate after a thorough convalescence. This operation is termed the "interval operation." During the interval between the attacks the physical condition of the patient is usually better. Great stress should be laid on what I have previously mentioned regarding the blood examination with especial reference to the leucocyte count and the percentage of polynuclear neutrophiles. If we have a high polynucleosis with a corresponding leucocytosis, then an operation is indicated.

There are a few guides which may be of assistance when the blood is examined from day to day. Daily variations in the leucocyte count in a suspicious appendicitis are doubtful. If the leucocytosis is stationary, then the abscess may be walled off. If the leucocytosis increases it means a spreading abscess. When the leucocytosis declines from day to day, and the symptoms become less pronounced, it means a favorable course and operation may be postponed.

If a general peritonitis is present operative interference must not be delayed. It is in this class of cases that we find a general septic process and in which, in addition to the local manifestations, we have a general systemic infection.

INTUSSUSCEPTION.

The most frequent form of obstruction of the bowel is that known as intussusception, or invagination of the bowel.

Intussusception involves three layers of the bowel, each layer consisting of all the intestinal coats: First, the outer layer is known as the intussuscipiens, the sheath or receiving layer; second, the internal is known as the entering layer which, together with the third, the middle or returning layer, constitutes the invaginated part known as the intussusceptum.

The clinical records show that about one-half of all cases occur at the junction of the small and large intestine.

When the ileum becomes invaginated in the colon, the condition is termed ileo-colic intussusception.

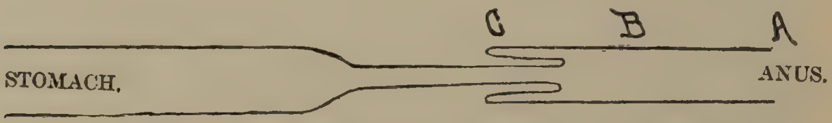


Fig. 80.—Mechanism of intussusception (Treves). The sheath at *A* passes to *B*, then to *C*. The lower part of the intestine is drawn over the upper instead of the upper crowded into the lower. For a fuller description see Treves's "Intestinal Obstruction," London.

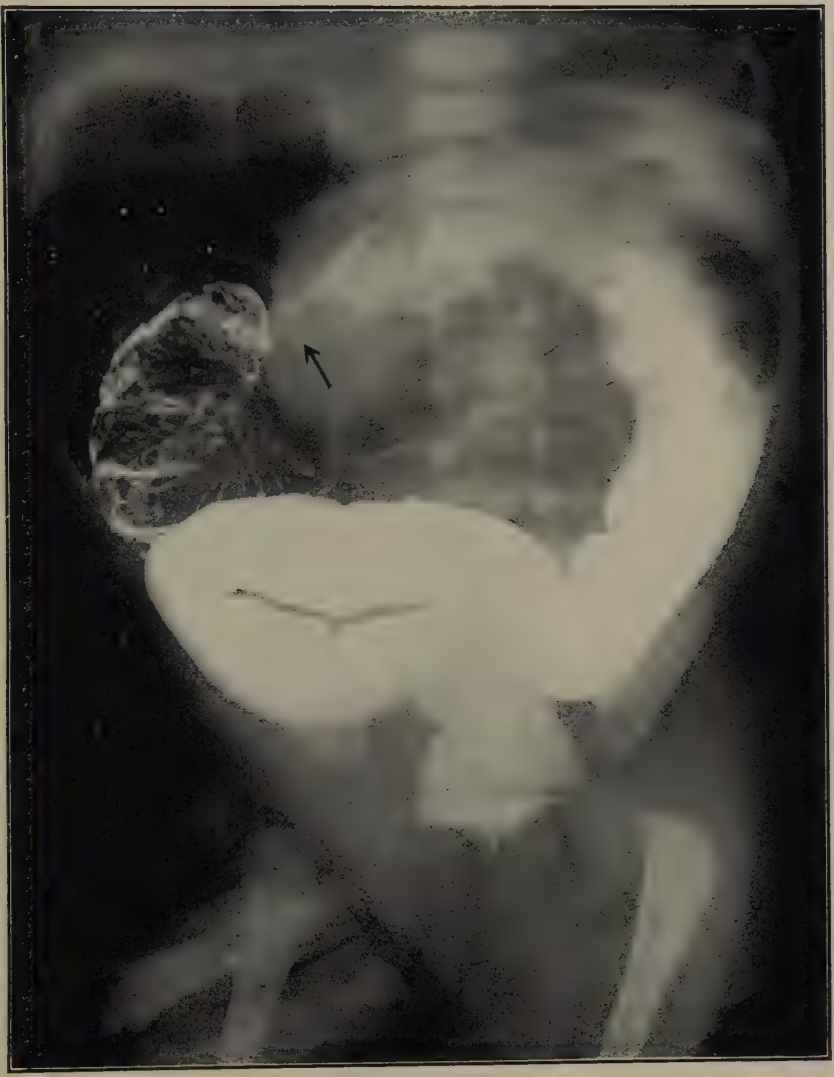
In less than one-third of all cases invagination takes place in the small intestine. This is known as ileal or jejunal intussusception. When this invagination takes place only in the large intestine it is called colic intussusception.

This usually commences at the ileo-cecal valve and extends downward. It is felt as a mass much larger than the swelling found in appendicitis.

Intussusception usually causes a distention of the abdomen from the side of the cecum, while appendicitis does not cause distention unless complicated by peritonitis.

Symptoms and Diagnosis.—Nausea and vomiting are among the earliest symptoms. Later in the disease the vomitus becomes fecal (so-called stercoraceous vomit) in character. The child has pain; assumes the dorsal position with the thighs drawn up on the abdomen. The pain appears in paroxysms, accompanied with a discharge of blood and mucus. Rectal tenesmus also is present. The temperature ranges between 101° and 103° F. The pulse from 120 to 150 per minute.

PLATE XVI



Intussusception. (Courtesy of *Dr. Reu.*)

Cases that give a clear history of intestinal obstruction with no stool passing, and vomiting caused by such obstruction, offer a good prognosis if operated early. Continued vomiting of food will cause exhaustion and rob the infant of the vitality necessary to undergo the shock caused by the operation.

The following case will illustrate intussusception as met with in general practice. The history was as follows:—

Infant B., 5 months old, had vomited for some time; was constipated, having had no stool for several days. The temperature was about normal; the abdomen was distended. The child was breast-fed. The breast was discontinued for a short time and barley water substituted to relieve the vomiting.

The vomiting continued in spite of the withdrawal of the breast-milk. Paroxysms of pain constantly recurring. Infant screaming. Repeated enemas did not result in emptying the bowels. Calomel had been given in both large and small doses with no satisfactory result. In addition thereto cathartics had been given. The vomiting persisted; at the same time the distention in the abdomen continued. The diagnosis of intussusception was made and an operation suggested. The family objected to an operation and palliative measures were used. The child died several days later. The symptoms which were most marked in this case were:—

1. Continued vomiting.
2. Fecal impaction, the gut being so obstructed that no feces passed in more than ten days, though flatus would occasionally pass.
3. During the first two or three days not only was clear blood passed per rectum, but large masses of jelly-like mucus tinged with blood were frequently expelled from the rectum until the end.
4. The distended belly, the abdomen abnormally distended, and very tympanitic on percussion.
5. The absence of all inflammatory symptoms such as rise of temperature until two days before the death of the patient, when the temperature rose to 101° F., and the pulse rose to 160.
6. Continued crying; the child with rare exceptions showed evidences of pain.

There was no positive etiological factor in this case, as there were two other healthy children in this family; the father and mother were in apparent good health. There was no evidence of traumatism nor anything that could be connected with the cause of this condition. The mother stated that for a period of two months before the appearance of this condition she had given a patent cathartic every day, as she thought, with advantage. Whether or no this drug had anything to do with this condition it is difficult to state. The presumption is, however, that the continued effect of giving cathartics was indirectly the cause.

In the above-reported case an operation was refused and the child died. The chances were in its favor:—

1. Because it was a well-developed and well-nourished baby.
2. Because it was breast-fed.
3. Because the diagnosis was made very early in the disease.
4. Because the heart action was very good, and no chronic or infectious disease existed.

Pilz[1] reported 94 cases under 1 year—mortality, 84 per cent. Another group of 135 cases under 1 year, gave a mortality of 59 per cent.

The reduction in percentage of mortality in recent years is evidently due to modern aseptic surgery. Whereas formerly recovery depended on sloughing, to-day laparotomy is the rule.

Two interesting clinical points which I have made use of are given by Caillé:—

1. Try to reduce the obstruction by non-operative means—injections of oil—the child in an inverted position following the injection; gentle manipulation of the abdomen.
2. In percussing the abdomen there will generally be found at the site of the obstruction a *very tympanitic area* adjoining a dull area. By carefully noting this point the surgeon has an important landmark for his guidance in performing the operation.

Prognosis.—Without operation the prognosis is exceedingly bad. The earlier the operation, the better the result. In some cases Nature relieves the invagination and a slough will separate. This is, however, a rare condition.

Treatment.—When the diagnosis is established no time should be lost. *Inflation of the bowel* with air or hydrogen through a long rubber tube has been recommended. When this is not successful the child may be inverted and gentle manipulation of the abdomen may be attempted.

Injections may be given with or without anesthesia. The baby is turned on its belly; the hips are raised by gently supporting the abdomen on a soft pillow. The mouth and nose, being the lowest part of the body, must be protected. The baby is then anesthetized with chloroform, and warm water is poured into the rectum with but little pressure, from a height not exceeding three feet. The injection is frequently intermitted; while the anus is closed with a cotton plug held by the finger. At the same time the abdomen, in the direction from below upward, is gently kneaded and its contents moved about.

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[1] Jahrbuch für Kinderheilkunde. Bd. iii, p. 6.

Unless this proves successful no time should be lost and an abdominal operation should be performed.

Although surgical interference offers the best means of treatment, we should note the condition of the child at the time of operation, and consider the result of shock and hemorrhage in estimating the therapeutic result. No cathartics should be given after the operation, but the bowels should be confined by administering a small dose of bismuth. Ten minims of pituitrin given hypodermically will relieve abdominal distention and cause the expulsion of flatus. Stimulation should be given *ad libitum.* It is well to remember that very young children do not offer good resistance to the shock of an abdominal section. Fully 50 per cent. of cases seen by me were fatal. For the details of an operation for intussusception my readers are referred to text-books on surgery.

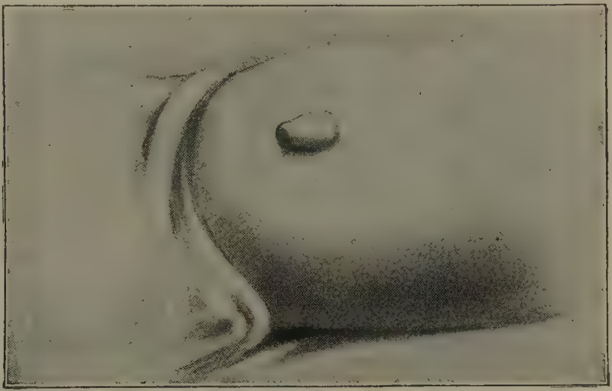

Fig. 81.—Umbilical hernia. The result of violent paroxysms of whooping-cough.

UMBILICAL HERNIA.[1]

This condition is frequently seen in both male and female children. It is more often seen in the female.

Causes.—It is usually found in children with flabby muscles such as rachitic and atrophied cases. Severe abdominal strain during the paroxysms of whooping-cough or in continued constipation frequently results in umbilical hernia. The hernia may be from one-half to one inch wide, and the same also in length.

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[1] For Inguinal Hernia, see chapter on Diseases of the Genito-urinary Tract.

Treatment.—*Preventive Treatment:* After the umbilical cord has been separated, the usual flannel binder may be used to lend support to the abdomen for the first two or three months.

Mechanical Treatment.—A pad of absorbent cotton into which a thick piece of cork or a wooden button the size of a 25-cent-piece is wrapped, should be snugly pressed over the protruding part and secured by thick straps of zinc oxide plaster. This dressing should be renewed every four or five days. The treatment must be continued for several months.

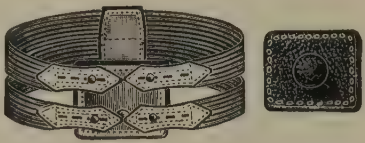


Fig. 82.—Umbilical hernia truss.

A truss consisting of a rubber pad and a belt to pass around the body should be applied so that it cannot slip and has enough pressure to keep the hernia in place.

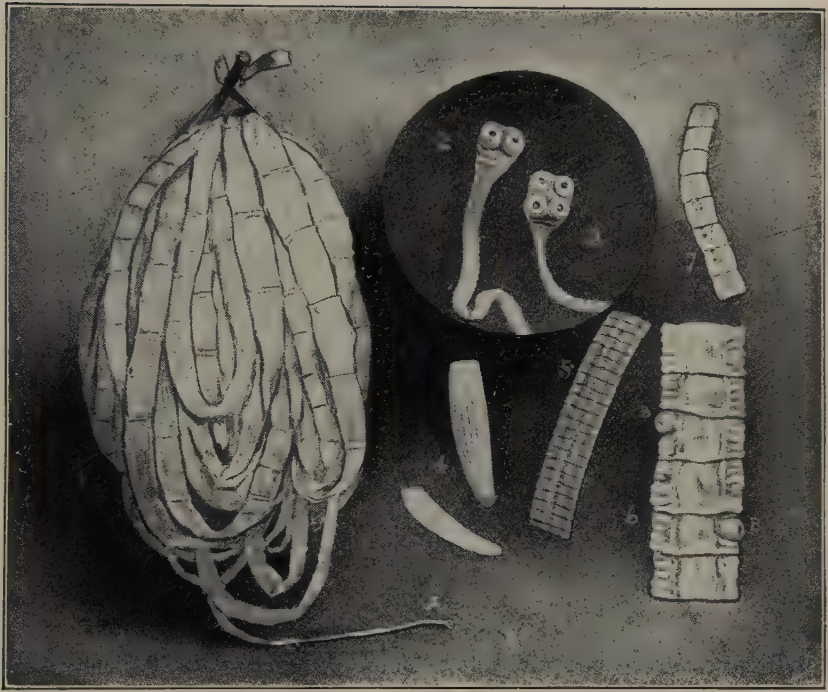
TAPEWORM (CESTODES).

The tapeworm enters the body by food containing the larvæ. Several varieties are met with. When the worm is fully developed it consists of rectangular segments or pieces. These segments are also called proglottides. The head and neck of the worm are called scolex.

The eggs (larvæ) of the tenia solium are found in pork; tenia mediocanellata, in beef; bothriocephalus latus, in fish; tenia cucumerina, in dogs and cats.

Development of the Worm.—A worm develops in about three months. When the terminal segments are mature they separate and are discharged in the stool. As each segment contains both male and female organs, each one is capable of regenerating a whole worm. For this very reason the treatment of a tapeworm will never be successful until the head and every segment has

PLATE XVIII



Cestodes (Tape-worms). 1, Tænia saginata. *A*, Head of tænia saginata. 2, Dorsal view of the head. 3, Apex view of head, showing depression in center. 4, Isolated, elongated segments. 5, Bothriocephalus latus. 6, Ripe segments of tænia saginata. *B*, showing location of sexual organs. 7, Half-developed segments of tænia saginata. Illustrations drawn from specimens.

been expelled. Tapeworms are estimated to live from ten to twenty, possibly thirty, years.

The beef tapeworm is the *most frequent* found in children. It has four suckers, a square head, and no hooks. Raw meat may contain the cysticerci.

The pork tapeworm is the *rarest* found in children. The head has four suckers, surrounding which there is a circle of about twenty-six hooks. The length of the worm varies from ten to fifty feet. Nursing children are exempt from tapeworms.

Symptoms.—In children between 2 and 4 years of age subjective symptoms are difficult to interpret. In older children we will notice attacks simulating colic associated with fairly good movements of the bowels. There is restlessness at night and marked nervous irritability by day. The breath is foul and the child presents evidences of marked anemia. In spite of an abnormally large appetite the body wastes and the child is believed to suffer with some latent form of tuberculosis.

Diagnosis.—The diagnosis is positive only when segments of the worm are found. The absence of cough or pulmonary symptoms will usually aid in excluding tuberculosis. At times several weeks will pass before a positive diagnosis can be made.

Prognosis.—The prognosis is usually good. It is simply necessary to use radical treatment to dislodge and sicken the worm and then expel it.

Treatment.—The tenicide should be given after fasting and followed in an hour by a cathartic to carry off the worm. The best tenicides are pomegranate or its alkaloid, pelletierine; filix mas; kousso; pumpkin-seed, and turpentine.

℞ Oleores. filix mas	1½	drams.
Chloroform	10	drops.
Syr. ginger q. s. ad	1	ounce.

M. Sig.: Divide into 2 parts. Take on empty stomach, half-hour apart.

For a child 10 years old, younger children one-half the dose.

℞ Tannate of pelletierine	½ grain.

M. Sig.: For a child 3 to 5 years old.

℞ Olei terebinthinæ	1 fluidram.
Olei ricini	½ ounce.

M. Sig.: Take it in one dose (Farqhuarson).

Since entire expulsion of the tapeworm is effected with difficulty, preparatory treatment for about forty-eight hours should be employed before the vermifuge is administered. During this time the patient should. take a mild purgative once or twice, and such food in moderate quantity should be allowed as leaves little residuum, as beef-tea, etc., with some stimulant if the patient feels exhausted. There are three articles of food which experience has shown to be especially useful in this preparatory treatment, perhaps from a sickening effect which they produce upon the worm, namely, salt herrings, onions, and garlic. These may, therefore, be taken as food in the twelve or eighteen hours preceding the employment of the vermifuge, which it is ordinarily most convenient to administer in the morning.

ASCARIS LUMBRICOIDES (ROUND WORM).

This worm is a reddish or yellowish round worm, usually from 5 to 10 inches long. The male worm is smaller than the female. This worm inhabits the small intestines. It is seldom found solitary, but usually 4 to 10 may be present. Some authors state that as many as 200 and 300 have been found at one time. The worm is usually found in children between the second and tenth years. It is never found in nurslings. These worms will wander from the small intestines into the stomach and irritate the gastric mucosa. They are frequently expelled by vomiting.

A child 4 years old was seen by me during my service at the Willard Parker Hospital. The child had pharyngeal and tonsillar diphtheria. It was a septic type of diphtheria. The child vomited a round worm about 6 inches long on the second day after admission. On the third day another worm about 5 inches long was also ejected by vomiting. There were no symptoms pointing to the presence of these round worms.

Some authors report worms wandering into the nose and also into the middle ear. A worm entering the larynx has produced fatal asphyxia. Another author reports jaundice due to worms entering the common bile duct. Worms have been known to produce hepatic abscesses. They have been found in the vermiform appendix. These worms appear most frequently in the stools. They have been. found in umbilical abscesses.

Symptoms.—Very indefinite symptoms can be ascribed to these round worms. Irritation, such as restlessness at night, grinding of teeth, picking the nose, and scratching the anus. Abdominal symptoms, such as colic, diarrhea, and tympanites, are frequent. This clinical picture must not be presumed to be present in all cases. Not infrequently symptoms of meningitis will be mistaken for worms. Be sure to exclude all other conditions before expressing a positive opinion. Nervous symptoms, such as hysteria, vertigo, and epileptiform convulsions, have been noted while worms existed. As these conditions disappeared when the worms were expelled, it is but fair to presume that they were indirectly the cause of these nervous manifestations.

Diagnosis.—A positive diagnosis can only be made if the round worms are discharged from the body or if the ova are discovered in the stool. The microscopical examination, therefore, is very valuable and should always be made when in doubt. If the ova are still found in the stool after one or two worms have been expelled, then more worms should be suspected.

Prognosis.—The prognosis is always good, but the child must be kept under constant observation for at least several months.

Treatment.—To eliminate worms from the body, the tenicide should be given for several days and then followed by a brisk cathartic. The following formulæ have served me very well:—

℞ Magnesii sulphatis	4 drams.
Syrupi rubi idæi	2 fluidounces.

M. Sig.: A tablespoonful two or three times a week, to be preceded by santonin,[1] spigelia, or chenopodium. Once a day a high enema of soapy water should be given. The folds of the anus should be carefully cleansed with soap and water, and the following ointment applied:—

℞ Acidi borici	1 dram.
Olei rosæ	3 drops.
Vaseline	1 ounce.

M. Sig.: Apply externally.

Other tænicides recommended by Townsend are:—

℞ Ext. spigeliæ	10 fluidounces.
Ext. sennæ	6 fluidounces.
Olei anisi	20 minims.
Olei cari	20 minims.

M. Sig.: Half-teaspoonful for a child 2 years old, two or three times daily. Teaspoonful for a child from 4 to 10 years old.

Or:—

℞ Oil of chenopodium	2 drams.

Sig.: To be given on sugar three times daily, in doses of 5 drops, to a child of 3 years. Ten drops to a child of 10 years. A cathartic should be given every second or third day.

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[1] The formula for santonin is given in the chapter on Oxyuris Vermicularis.

OXYURIS VERMICULARIS (PINWORM; THREADWORM).

The female worm is thin, yellowish white, and has a pointed tail. The male has a strongly curved tail. *The male worm is rarely found in the stool.* The female worm is present in greater number than the male. The oxyuris is frequently passed in the mucus during a catarrhal discharge from the rectum. These worms frequently wander from the rectum into the vagina.

Symptoms.—Irritation and itching of the anus, causing restlessness and severe nervous manifestations, usually appear after the child is in a warm bed. The itching frequently gives rise to a desire for frequent urination. In severe cases it may lead to masturbation. The constant scratching to relieve the itching has produced vulvitis and vaginitis. Convulsions have been brought on by reflex irritation due to the presence of worms.

Treatment.—Threadworms are most effectually and easily removed by the use of enemata. For this purpose lime water, or an infusion of quassia, or solution of common salt (a teaspoonful of salt to 4 ounces of water) may be employed. In using these agents the bowels should first be cleansed by a copious injection of warm water. A decoction of garlic as an enema in these cases will be of value.

℞ Santonin .... 1 to 2 grains.
Mild chloride of mercury (calomel) .... ½ grain.

M. Sig.: Every night for two or three nights, to a child 5 or 6 years old, and followed each morning by a purgative dose of castor oil.

Or:—

℞ Santonin .... 1 grain.
Compound liquorice powder .... 2 drams.

UNCINARIASIS (HOOKWORM DISEASE).

The American worm was discovered in 1899 by Bailey K. Ashford. It is named Necator Americanus. It is about half an inch in length, and has the appearance of soiled spool cotton. The larvæ enter the system through the soles of the feet, and finally lodge in the intestinal tract.

The symptoms are extreme pallor of the skin, profound anemia, excessive appetite, occasional abdominal pains, and tenderness. The bowels may be constipated or loose; the stool is fetid. There is palpitation of the heart—a hemic murmur. Hemoglobin percentage drops to between 30 and 60 and the red cells from 3,500,000 to 4,000,000 per cubic centimeter. There is a marked eosinophilia. There is marked weakness and a disinclination to play.

When the symptoms are more severe, there is an edema of the feet and ankles, and puffiness of the face is noted. Sometimes a jaundiced condition exists. Some cases show emaciation. The nervous system is disturbed, there is marked insomnia, and the urine contains traces of albumin, but no casts.

The stools should be examined for the ova while fresh. The ova are found with greater ease in partially formed or soft stools. In preparing specimens a drop of water is placed on a clean slide and a bit of fecal matter is taken up on a platinum loop; this is thoroughly mixed and a cover glass placed over the specimen, after which it is examined microscopically.

Treatment consists in giving thymol in 5-grain doses, every hour for 4 doses. In view of the toxic qualities of thymol, it is advisable to first thoroughly test the eucalyptus treatment, which is recommended by many for treating this disease.

℞ Eucalyptus oil .... 2 drops.
Chloroform .... 1 drop.
Castor oil .... 2 drams.
Sig.: One dose *t. i. d.* Repeat treatment several days.

Chenopodium oil has been successfully used in the treatment of this disease. It should be given in 5- to 10- minim doses on a lump of sugar, and repeated if necessary in two-hour intervals until three doses have been taken. After the last dose several teaspoonfuls of castor oil should be given.

V.

DISEASES OF THE RECTUM.

FISSURE OF THE ANUS.

An ulcer having its long diameter parallel with the long axis of the bowel is occasionally met with. It occurs at the anal margin. It is seen in infants as well as in older children. It is caused by the passage of irritating hard fecal masses. It is also occasionally seen after prolonged diarrhea with continuous straining. Some authors state that traumatism from the nozzle of a syringe may cause a fissure. This I have never been able to verify. Streaks of blood of a bright red color will usually be seen in the stools when a fissure is present.

The prognosis is good.

Treatment.—This should be mainly hygienic, and consist in a thorough cleansing of the parts. The application of solid nitrate of silver will usually effect a cure. The bowel should be relieved daily by the injection of sweet oil or glycerine to soften the feces. Some authors advise stretching the sphincter of the anus and keeping the parts at rest.

SIMPLE CATARRHAL PROCTITIS.

The rectum is rarely inflamed without additional portions of the bowel being involved. When the same exists, local causes must be looked for; for example, carelessness while irrigating the rectum. Corroding or caustic drugs can set up an inflammation. An instance of this kind occurred in my practice when a child received a strong injection of carbolic acid, causing inflammation. Infection extending from the vagina or urethra, such as gonorrhea or diphtheria, can cause this condition. Syphilis has been known to affect the rectum. In simple catarrh the pathological lesions are the same as those found higher up in the gut.

The symptoms are pain when the bowels move. The stool contains mucus, which may be distinctly separate. When folds of mucous membrane protrude they are very angry looking and show a deep red pigmentation. Children old enough will complain of intense burning and itching.

The treatment consists in using bland injections such as oatmeal water or starch water; when severe tenesmus exists, bicarbonate of soda, a teaspoonful to a pint of water, is beneficial.

CROUPOUS PROCTITIS.

This is the form usually associated with diphtheria of the genitals. Large and small pieces of mucous membrane are found mixed with the stool. Pathogenic bacteria, such as the streptococci and staphylococci, are found in the dejecta.

The treatment consists in using bland antiseptic irrigations, bichloride of mercury, 1 to 5000, or a normal saline solution, repeated several times a day. If diphtheria is present, antitoxin should be given (see chapter on Antitoxin).

If syphilis is present the usual treatment for the same (see chapter on Syphilis) is indicated.

ULCERATIVE PROCTITIS.

Tuberculous ulceration of the rectum has been reported by Steffen; also by Holt. Syphilitic ulcers are rare in children. There is usually bleeding and tenesmus. The blood is of a bright red color. The diagnosis is easily made by examination with a speculum and by no other means.

The treatment is very difficult. First, cleanse the rectum. Apply, locally, nitrate of silver with the aid of a speculum. The insufflation of aristol, dermatol, or boric acid is very useful.

HEMORRHOIDS.

The superior, middle and inferior hemorrhoidal veins anastomose freely in the hemorrhoidal plexus under the rectal columns. This plexus forms a union between the portal and the systemic systems of veins. The absence of valves in the superior hemorrhoidal veins and the constriction they are subject to in passing through the muscular coat causes venous stasis which is the most frequent cause of hemorrhoids. It usually accompanies chronic constipation.

An instance of this kind was seen by me in a child about 2½ years old, which was referred to me because it could neither walk nor talk. In this case chronic constipation was associated with hemorrhoids. The stool was so hard and dry that blood was occasionally found after severe tenesmus. Thyroid treatment was directed against the cretinism, and malt extract ordered to overcome the constipation.

The local application of:

℞	Gallic acid	2 parts.
	Cold cream	30 parts.

applied three times a day, is beneficial. The parts should first be cleansed with alcohol and water, then dried, and the salve applied.

When large hemorrhoidal veins obstruct the anus and rectum, surgery will afford relief.

ISCHIO-RECTAL ABSCESS.

In excoriated conditions around the anus, following continued diarrhea, an infection frequently results from scratching. Pyogenic bacteria undoubtedly enter the lymph channels, and infect the adipose tissue in the ischio-rectal fossa.

An infant nursing at the breast had dyspeptic symptoms, such as flatulence, and, later, intestinal catarrh. An ischio-rectal abscess developed later on. It was benign and required a simple incision. This condition lasted in all about two weeks. The child made a splendid recovery.

At times we meet with very deep-seated inflammation which requires the skill of the surgeon. When a fistula exists proper surgical treatment is indicated.

PROLAPSUS ANI.

When children strain, especially during constipation, prolapse of the anus frequently follows. Not infrequently as much as one or two inches of the mucous membrane protrudes.

Causes.—There are three main causes: First, weakness of the levator ani muscles. In general atonic conditions—for example, in rickets—this condition frequently follows constipation, the constipation being a part of the rickety condition and indirectly causing a straining during defecation, thus ending in prolapse of the rectum. Deficient peristalsis, especially in young children, induces them to strain to expel hardened fecal matter. On the other hand constant diarrhea and irritation in the lower bowel may also result in prolapse. When an attack of summer complaint has lasted a long time, we usually find at the end of defecation that the rectum protrudes.

Second, when the ischio-rectal fat is deficient. In marasmic conditions, such as in athrepsia infantum or following the acute infectious diseases, when high fever and general wasting have taken place, the body fat suffers, and so the mechanical support of the rectum is lost.

Third, traumatic condition. This condition is frequently induced by coughing paroxysms, hence it not infrequently follows whooping-cough. Retention of urine, phimosis, and vesical calculi may cause this condition.

Diagnosis.—The size and the location of the mass, and its appearance during the straining while at stool, render the diagnosis easy. The ease with which the prolapse can be replaced is noteworthy in making a diagnosis. It is rare for this condition to be mistaken for intussusception (see chapter on Intussusception).

Treatment.—*Local:* Place the child in the knee-chest position and apply olive oil to the prolapsed bowel, after which the gut can be replaced. When this mild manner of reduction is not successful, a whiff of chloroform should be used to quiet the child. This will also relax the protruding part. After replacing the gut the buttocks should be supported by a stout strap of adhesive plaster running from side to side. Cold water irrigations should be given. These will have the two-fold object of emptying the lower bowel as well as toning the muscle. Astringent injections of sulphate of zinc, 1 grain to the ounce, or tannic acid, 10 grains to the ounce, are recommended by some. I have failed to see any benefit therefrom. The local application of the tincture of the chloride of iron once every three days has seemed to be of some benefit. The solid stick of nitrate of silver or cauterization by means of the Paquelin cautery, made red hot, is frequently recommended. Heroic measures, such as amputation of the parts, are rarely, if ever, necessary.

Constitutional Treatment.—We must not expect to cure a condition of this kind unless the body is strengthened. Restoratives, cereals, eggs, and milk must be prescribed. We can supply a deficiency of fat by ordering codliver oil, 1 teaspoonful three times a day. When constipation exists the addition of malt, as in a malted food, will aid this condition. Strychnine may be given in doses of $\frac{1}{100}$ of a grain, and increased gradually until $\frac{1}{60}$ of a grain is given, three times a day. Iron can also be given with great advantage. Massage of the abdomen and electricity must not be forgotten. A cold shower or spray over the spine and abdomen, repeated every day, is an excellent tonic.

RECTAL POLYPI.

Polypus of the rectum is very common in early life. When bleeding occurs it may be due to a fissure or to a hard scybalous stool tearing the mucous membrane. It may be caused by a rectal polypus. Frequently we find this condition in syphilis.

The treatment consists in tying off the polypus with fine catgut or snipping the polypus with a scissors and then cauterizing the base.

VI.

DEFICIENCY DISEASES AND DISORDERS ARISING FROM IMPROPER NUTRITION.

FAULTY METABOLISM.

This condition is primarily due to faulty feeding, or to conditions associated with improper nutrition whereby faulty metabolism results. It is found in infancy, but is also very prevalent in older children between the ages of 4 and 14 years. We find a subnormal condition of the skin which may be cold or moist, or the skin may be found dry, and the circulation poor. The extremities are cold; cyanosis is not present. Such children frequently have marked vasomotor disturbances manifested by unilateral flushes of the face, of one ear, or the nose. The elasticity of the skin is much less than normal. Adipose tissue is usually lacking, although this type of case may be unusually fat. Such adiposity is due to faulty assimilation. The child shows the evidence of defective nutrition. It is underfed. If it is not underfed, then the food is not assimilated. Sometimes both quantity and quality of food are properly regulated and still subnormal conditions prevail. An absence of the intestinal secretions due to functional inactivity of various glands associated with the digestive tract is most probable because such cases have:

First. **Lienteric stools** in which undigested particles of food may be found. Such lienteric condition may be modified by a stimulation of glandular activity, such as the salivary and peptic glands. We must not undervalue the rôle played by the pancreatic ferments, and the necessity for that most important of all glands, namely, the liver. Inactivity on the part of the liver and the absence of a proper secretion of bile are two of the most potent factors in causing faulty metabolism.

Second. **Scybalous Stools.**—When dry, round, fecal masses stagnate in the colon they set up a series of symptoms which yield one of the most frequent sources of trouble in children. In this type of stagnation of feces, one of the prime causes is the absence of tone to the intestinal muscles, but the dryness and lack of secretion *per se* is due to the absence of proper lubrication from a subnormal mucous membrane. It is plain, therefore, that we must seek the origin of this trouble in a deficiency of the secretions previously named or in the absence of a proper secretion of bile. The bile salts, especially in infancy and childhood, have a most important bearing on the efficiency of digestion. Unless the liver performs its function, faulty metabolism is inevitable. Whenever possible the urine should be examined for the presence of indican. Indicanuria usually accompanies stagnation of intestinal contents, and is frequently associated with symptoms that make up a clinical picture of autointoxication of the intestine. Fever, so-called absorption fever, is usually a bi-product of this stagnation, and the temperature will range from 100° to 102° F. for many weeks, or until the diet is so reduced and the gastrointestinal tract so cleansed that intestinal stagnation is impossible.

If the bones do not get a sufficiency of calcium salts, they will lack hardness, and rickets will result. A deficiency of lime salts in the bones is evident in the teeth, which show carious manifestations and a breaking down, so-called chalky teeth.

What applies to the bones is true also concerning the muscles. The muscles are flabby and soft, and show the lack of tone that good healthy muscular tissue should show. Such children are very restless at night; as a rule the general atony of the muscles of the bladder results in enuresis.

The atony of the intestine is evident in deficient peristalsis and consequent coprostasis. The obstipation if present results from dryness and lack of secretion in the intestine; hence scybalous stools are noted.

Faulty metabolism is very evident in the nasopharyngeal tract. Such children have the adenoid habitus, they are prone to infections, and are constant sufferers from tonsillitis and swelling of the adenoid vegetations. The cervical glands are usually enlarged. These children are frequently victims of bronchitis and pneumonia.

Owing to this subnormal condition the immunity of the body and the phagocytosis are so greatly minimized that such children not only invite all exanthematous infections but frequently succumb therefrom. Due to this lack of vitality, one is not surprised to see a slight rhinitis extend through the Eustachian tube and set up an otitis media ending in mastoid infection. It is this class of cases which if first seen by the laryngologist will be treated by curetting adenoids if present, and likewise by the removal of tonsils if hypertrophied.

Catarrhal Tendencies.—These cases are brought to the pediatrist weeks and months after such primary operation for the relief of three serious symptoms which were the reason for the nasopharyngeal treatment. These symptoms are: Loss of appetite, no gain in weight, and general restlessness and irritability. These three symptoms stand out prominently in the picture which, summed together, spells faulty metabolism.

Nervous Manifestations.—There is an irritability and sensitiveness simulating hysteria in the adult. Such children are easily dissatisfied. They cry on the slightest provocation. They are peevish and hard to please. This applies not only to their clothing, surroundings and playmates, but, equally so, their food cravings are abnormal. They insist on sweets, also crave sour foods and condiments. Biting of the nails, thumb sucking and masturbation in the form of thigh friction may be started by an excoriation around the genitals and anus, caused by very acid or ammoniacal urine.

These cases frequently have a distinct resemblance to hereditary syphilis. The differential diagnosis can be determined by securing a family history, and noting the presence or absence of Hutchinson's teeth. If still in doubt with the absence of such important data, a Wassermann reaction will aid in establishing the diagnosis. Faulty metabolism is an important factor in tuberculosis as well as syphilis, and the exclusion of such diseases must be positive. There are thousands of children whose sallow appearance and shriveled skin imply an abnormal state of health which requires vigorous treatment if results are to be obtained.

Treatment.—If we are dealing with a distended colon or distention of the stomach associated with flatulence or eructations of gas, then starches in all forms must be excluded. Potatoes, bread, cake, and all flour foods must be stopped. In addition thereto all cereals such as rice, barley, and cornstarch must be excluded. The stool should be examined to see whether it contains gaseous bubbles and mucus or whether the consistency is solid. In a young child a strict diet of milk, eggs, and cream cheese is indicated. An older child may have milk, cheese, eggs, junket, custard, fish, meats, and all green vegetables. Stewed fruits and fresh fruits are indicated. The question of assimilation of food depends greatly on a regular four or five hour interval between each meal, with fresh air and outdoor exercise, and not overfilling the stomach with large meals.

Nux vomica in doses of 1 to 5 drops before each meal, depending on the age of the child, is an excellent tonic. Pancreatin in doses of 1 or 2 grains may be combined with the nux vomica.

The weight is an important guide as to the progress of proper metabolism. A mild laxative such as 15 to 20 grains of calcined magnesia can be given every morning if necessary. The child must not be permitted to retire without an evacuation of the bowel. One-half pint of soap-water may be given as an enema if necessary.

A change of air from the city to the seashore for several months during winter or summer will frequently aid in establishing normal conditions. Some children will be benefited by a change to the mountains. The influence of a tepid both followed by a cool shower, or a cold bath in the morning, if the child can tolerate the same, is an excellent tonic. Such cool baths should be followed by friction of the skin to stimulate the cutaneous circulation. It is an excellent vasomotor stimulant.

Some of these cases may require a mild faradic current of electricity applied over the stomach and intestines. By such treatment the plexus of nerves is easily stimulated to advantage. The electricity should be given for several minutes every other day, and if well tolerated may be given daily for a month or more.

ACIDOSIS.

Acidosis is a condition in which there exists a diminution in the alkali reserve of the body, that is, a decreased amount of alkaline salts in the blood and a low carbon dioxide content of the alveolar air.

Carbonate depletion from the blood plasma causes rapid breathing, quick pulse, flushed face and a clinical picture resembling pneumonia. In fact many cases of true acidosis are frequently diagnosed incorrectly as pneumonia. One of the most striking results of the carbonate depletion from the blood plasma is "a cyanotic hyperpnea," in other words rapidity of breathing without blueing of the skin. The loss of carbonic acid carriers makes rapid breathing necessary to compensate for the small quantity of carbonic acid gas which can be got rid of at the lungs' surface during a single respiratory act, and the same necessity explains the quick and rapid heart action.

Acidosis is not a disease, it is a symptom. It is a condition found in many diseases, most frequently in the acute gastro-intestinal infections. It also is frequently found associated with such acute infectious diseases as influenza and pneumonia.

According to Rhamy, organic acids, beta-oxybutyric and diacetic, with acetone, comprise the acetone bodies. It has been said that beta-oxybutyric acid is the precursor of diacetic acid and acetone the final product of the series; yet there is no good reason for so believing, except the order of their appearance in the urine, the similarity of their chemical formulas, and the fact that diacetic acid, when heated, changes to acetone. Against this view is the fact that acetone can readily be formed from a number of other substances. Furthermore, the administration of sodium acetoacetate is followed by the elimination of beta-oxybutyric acid, just the reverse of the common understanding of their order of formation.

Rhamy finds that acetone bodies constantly appear in some lesions of the pancreas, which fact, too, is in accord with the intestinal origin of some cases of acid intoxication, since disturbances of pancreatic function would reduce digestive activity in the duodenum with resulting faulty cleavage of fats. We know that acetone is found in very small amounts in the urine of healthy children, never exceeding 1 centigram in twenty-four hours (Langstein and Meyer). Acetone and its associates, diacetic and oxybutyric acid, are possibly being constantly formed in minute quantities in normal metabolism.

Reiche found acetonuria present in 60 per cent. of a series of thirty-two hundred diphtheria cases. Their occurrence has been noted in scarlet fever. In children it is invariably true that acidosis in the body is accompanied by an increase in the excretion of ammonia.

Rachford has suggested that the acids, besides removing alkaline bases which are needed in metabolism, have a direct toxic action in that they bring poisonous alkaline bases (as ammonia) into the blood. Ewing, too, from his experimental work, has concluded that the intoxication may be due to the accumulating antecedents of urea. He adds that none of the principles of the theory of acid intoxication have been proven—namely, carbon dioxid asphyxiation, degeneration of the vital organs by withdrawals of alkalies and reduced alkalinity. This would lead us to believe then, that the acetone bodies are derived from fatty acids imperfectly metabolized in the liver; that this imperfect metabolism may be coincident with lessened sugar combustion; but that there is an immediate exciting cause for this imperfect metabolism.

There are several types of acidosis. In the one, there is imperfect metabolism of fat with lessened sugar combustion in which acetone bodies most likely arise from fatty acids. Thus may be formed a gastric or gastrointestinal type of acidosis.

Another type is the one met with during the acute exanthematous diseases such as in diphtheria and scarlet fever, as well as in pneumonia and meningitis.

A third type is noted after poisoning by phosphorus, salicylate and similar drugs; shock, fright, poisoning associated with anesthesia and appendicitis.

A tendency to the development of this condition exists in many children. As a rule they are high-strung, nervous, hypersensitive children of the so-called neuropathic type. Whether or not the neurosis inhibits the proper functions of the peptic glands, the pancreas, and the liver is hard to determine although it seems plausible. We are positive that the intestinal secretions, as such, are modified in quality or quantity thus permitting an imperfect or incomplete digestion to take place. In consequence there is a stagnation and irritation caused by the gastric and intestinal contents from which imperfect metabolism results. The imperfect metabolism permits putrefactive bacteria to interfere with the assimilation of food, thus will begin a train of symptoms resulting from intestinal fermentation with excessive acid formation.

Symptoms.—The breath of a child suffering with this condition has a peculiar sweetish odor. As a rule the tongue is dry. There is a deficiency in the quantity of saliva secreted. As with the peptic glands so the salivary glands do not properly functionate. The urine is acid. From the fever there is usually a trace of albumin. Acetone is present in a very large amount, diacetic acid also is found. There is vomiting and fever, the temperature ranging between 102° and 104° F. The pharynx is reddened, the tonsils appear swollen.

Mild Attack.—Acidosis may be a primary condition, that is, a child may be in apparent health and have a sudden attack of this condition without any previous gastric derangement due to imprudent diet. On the other hand acidosis may be secondary to an attack of tonsillitis or may complicate measles or any of the acute infectious diseases. Acidosis may frequently follow etherization.

Severe Attack.—When the attack is severe we have a stuporous or even a semi-comatose condition. The eyes appear sunken and have dark circles about them. Profound toxicity can be noted. Such children appear to be in a typhoidal state. Vomiting is more pronounced in severe cases and the smallest quantity of food and water will not be retained. The urine is scanty and high colored. Tenderness over the stomach and in the abdomen is frequently present to such an extent as to mislead one in the diagnosis of a probable appendicitis. The vomiting, fever, and stupor have frequently led to the diagnosis of meningitis being made, but the acetone odor of the breath, and the frequent recurrence of these attacks will differentiate this condition from one of meningitis. The pupils are normal and respond to light. The reflexes may be slightly exaggerated or otherwise normal. There is no rigidity of the neck, neither is there a Babinski nor a Kernig present. The tâche-cerébrale is rarely present, and if so in a very mild form. Lumbar puncture if made will yield a clear transparent fluid in which no microorganisms can be demonstrated.

The stool contains mucus and sometimes undigested particles of food. Occasionally the stool will be streaked with blood.

The following case will illustrate the form of acidosis usually met with in well regulated families:—

Case I.—B. N., aged 4 years, had had measles, tonsillitis, otitis, bronchopneumonia, and several attacks of influenza. He was a bottle-fed infant, with deficient glandular secretion, an inactive liver, marked coprostasis, and hard, dry, scybalous stools, requiring laxatives almost daily for months. There was a general atony of the gastric and intestinal canal, with loss of appetite and deficient intestinal secretion as evidenced by the dry stool.

With the aid of general restorative treatment and continuous dieting, the child progressed favorably. He was normal mentally and his physical condition was up to the average. He was markedly neurotic, very sensitive, but a well balanced child otherwise. There were no stigmata nor hereditary conditions which could influence his present condition. Both father and mother were in good health. There was no taint of specific disease.

Despite continuous dieting, great care and supervision, with excellent hygiene, this child had, without evidence of gastric indiscretion, a sudden attack of anorexia, vomiting, a total refusal of food, and temperature ranging between 101° and 103° F. The pharynx was reddened, the tonsils swollen, and after the second or third day the lacunæ were filled with pin point deposits.

Bacteriological examinations made at least six times during these attacks, showed the presence of staphylococcus pyogenes aureus and an occasional streptococcus chain, but never the Klebs-Löffler bacillus. The urine was characteristic. The following analysis of urine was made on the second day of illness during one of these febrile attacks, and after the child had had three attacks of vomiting during the forenoon.

Reaction, acid. Sediment, very moderate. Nature of sediment, heavy. Albumin, faint trace. Bile pigment, absent. Urea, 1.2 per cent. by weight. Indican, no excess. Color, amber. Odor, not offensive. Specific gravity, 1.022. Sugar, negative. Acetone, large amount. Chlorides, 1 per cent. by weight. Phosphates, no excess. Diacetic acid, traces.

Examination of Sediment.—Blood, none. Pus, none. Mucus, small amount. Casts, none found. Bacteria, no apparent bacteria. Epithelium, few bladder cells.

Summary.—The specimen contains a faint trace of albumin, but no casts were found, with a normal gravity, and a considerably depressed relative amount of urea. A large amount of acetone and traces of diacetic acid are present.

The examination of the urine shows that there is a large amount of acetone, traces of albumin, and traces of diacetic acid. The casual study of many cases would lead one to believe that the gastrointestinal canal is responsible for these attacks. When the throat is carefully examined, however, we always find that deep seated, submerged, swollen tonsils are at the root of the trouble. Many of the patients suffer from inanition owing to these recurring febrile disturbances which deplete the body.

The following will illustrate a severe form of acidosis:—

Case II.—J. G. Six years old. The child complained of abdominal pains which were diffused over the stomach and colon. There was moderate distention, tenderness on pressure over McBurney's point, marked prostration, sunken orbits, and dark rings encircling the eyes. The child appeared typhoidal. All food, drinking water and medication were vomited. The stomach retained nothing. The urine contained acetone and diacetic acid.

There was a moderate leucocytosis of 12,100, polynuclears 57 per cent. The highest temperature curve was 105.4° F., pulse 160, respiration 30.

There was a distinct acetone odor to the breath. An intravenous injection of sodium bicarbonate was given. The following day the temperature dropped almost four degrees.

The case well illustrates the specific action and the rapid effect of the bicarbonate of soda solution when given intravenously.

Acetonuria is invariably present as long as the urine is acid. The acetone usually disappears a few days after the urine becomes alkaline.

Abt reports[1] an unusual type of acid intoxication in a breast-fed infant. The treatment consisted in weaning the baby from the breast-milk, giving rectal infusions of 8 per cent. glucose in normal salt solution, large doses of sodium bicarbonate by mouth, of whiskey in half dram doses every two hours, powdered casein in ½ dram doses on oatmeal gruel every two hours, soy-bean soup three times a day, occasional oxygen inhalations when cyanosis and dyspnea were most marked; and the subcutaneous infusion of sodium bicarbonate. Two per cent. levulose and sodium bicarbonate were given by mouth. The patient made a complete recovery.

Prognosis.—Acidosis with its extreme prostration and toxic appearance should never be regarded as anything but a blood poisoning. It is necessary to eliminate or to neutralize the acidity as early as possible before the danger point of collapse is reached.

Treatment.—In severe cases hypodermoclysis of a 10 per cent. glucose solution, using 4 ounces at each injection, may be given twice a day. By colon instillation we can give 1 dram of bicarbonate of soda to 8 ounces of hot water, at least twice a day. The temperature of the colon instillation should be 108° to 110° F. In very young infants, intravenous injections through the longitudinal sinus, in older children with large veins, through the median basilic or the jugular, of several ounces of a 10 per cent. sodium bicarbonate solution will aid in neutralizing acidity.

When typhoidal conditions exist such as extreme dryness of the tongue, dry skin, the sunken eyes with deep rings, cold perspiration, and cold extremities, then hot baths aided by hot blankets until perspiration results should be tried.

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[1] ABT: Amer. Jour. of the Medical Sciences, Jan, 1914.

Transfusion of 4 to 8 ounces of citrated blood (see article on Transfusion) will frequently save life. In an emergency one should remember that the agglutination and hemolysis tests so valuable in ordinary transfusions may be omitted in young infants as the danger of hemolysis is not great in infancy, especially if mother's blood is used.

The Murphy drip, using bicarbonate of soda solution is indicated.

Potassium citrate and sodium citrate used in conjunction with the sodium bicarbonate or alone serves very well. One ounce of citrate to 4 ounces of water. By giving ½ dram or 1 dram every hour the urine can be rendered alkaline in less than twenty-four hours. But it is necessary to continue the alkaline treatment for several days after the acidity of the urine has disappeared.

A cautious prognosis should always be given, even though the acidosis is of a mild nature. I have seen a mild form of acidosis become gradually worse within twenty-four hours, due to neglect. Such cases may begin with mild symptoms and be rapidly followed by coma, convulsions and death.

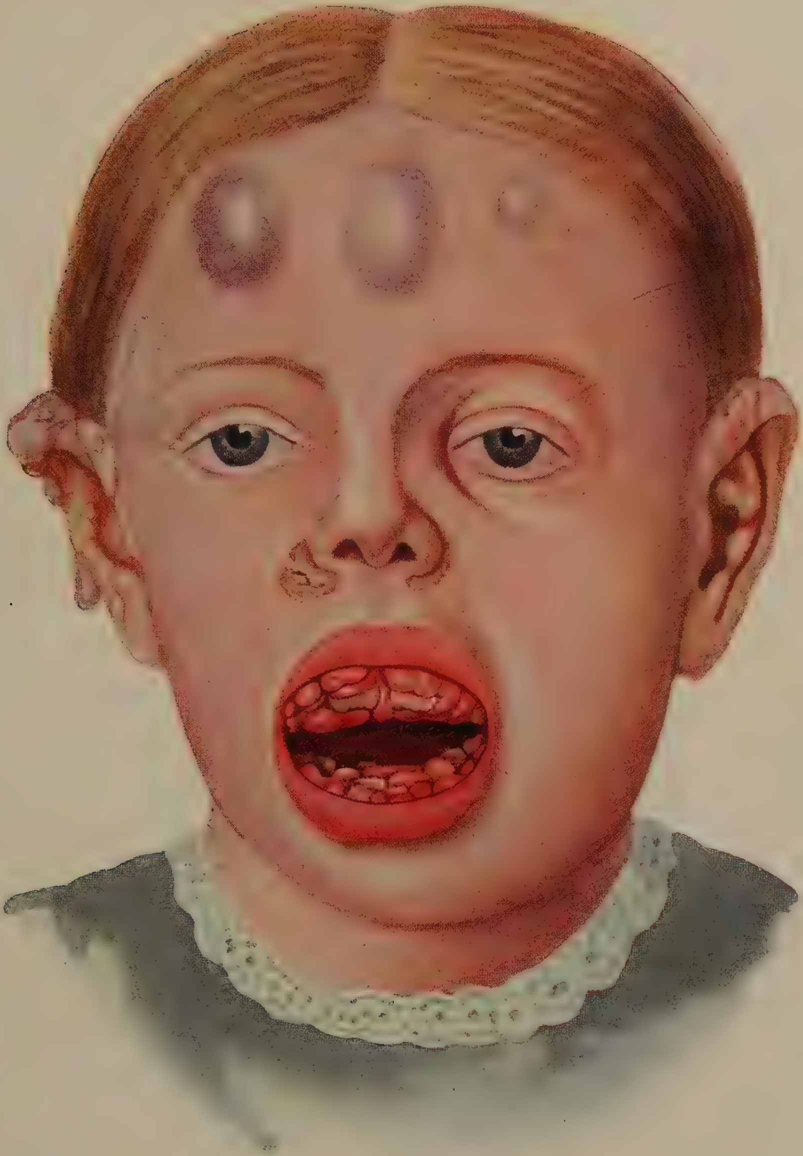
Many deaths occur because the disease is permitted to gain headway when it might have been arrested.

SCURVY (SCORBUTUS: BARLOW'S DISEASE).

This is a deficiency disease resulting from improper feeding in the sense that the food eaten prior to the development of scurvy lacked antiscorbutic vitamine. The disease is characterized by general debility, anemia, spongy gums, and a tendency to hemorrhages.

Etiology.—It usually occurs before the end of the second year, and rarely occurs before the first six months of a child's life. As in adults, scurvy is found when fresh food has been withdrawn from the dietary. This disease is liable to occur in either sex; it is not influenced by climate or locality; it is found as well in the best as in the poorest hygienic surroundings. By far the greatest number of cases is found among the rich. It is evident that this disease is due to improper feeding more than to an improper hygiene. Some authors believe that this disease is caused by a specific micro-organism; this latter fact has not

PLATE XIX



Infantile scurvy.[1] Ellen S. Five years old. The gums are swollen or beefy and hanging in tumorlike masses. There are also blood-tumors on the forehead. (From the pathological laboratory of the Great Ormond Street Hospital, London. Courtesy of *Sir Thomas Barlow.*)

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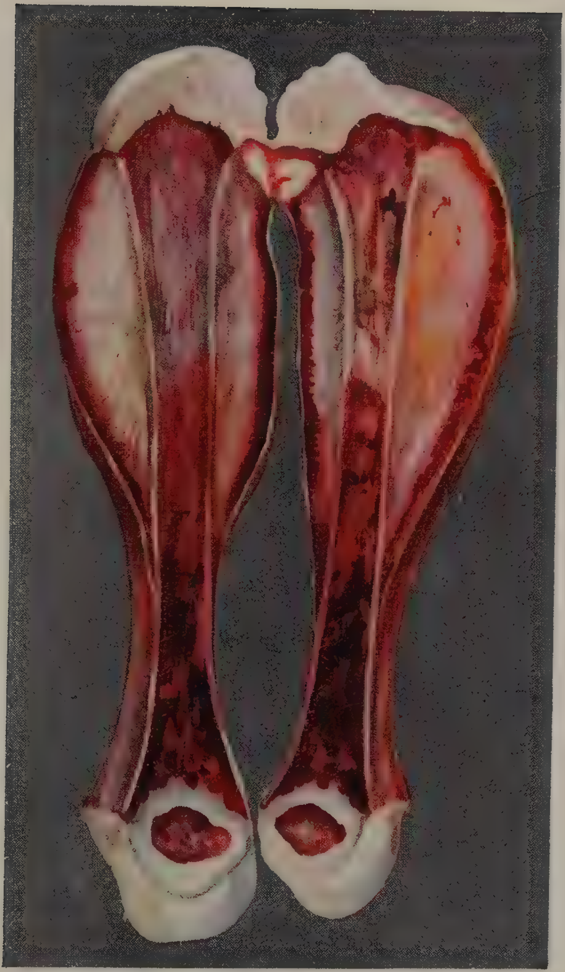
[1] I am indebted to Richard Armstrong, of the Great Ormond Street Hospital, London, for valuable assistance in procuring Plates XIX and XX.

PLATE XX



Infantile Scurvy. Femur divided by anteroposterior section, showing the characteristic scorbutic changes; including fracture of the shaft at about a quarter its length from the head, and displacement of the upper epiphysis. The especial feature is the wide separation of the periosteum from the upper half of the bone by a new bone which has been organized from a pre-existing subperiosteal hemorrhage.

yet been definitely settled. It is natural, therefore, to look for scorbutic cases among children who are:—

First, deprived of breast-milk.

Second, in those brought up exclusively on milk which is devitalized by *prolonged sterilization.*

Third, it is found in children brought up on condensed milk and on those *proprietary foods to which fresh milk has not been added.* There seems to be, therefore, a direct relationship between the absence of fresh milk, be it cows' milk or human milk, and the development of this disease. It is a great mistake to attach importance to the fact that an infant was fed on a proprietary food unless we know whether or no fresh milk was added. It is the absence of vitamine C in fresh milk which directly causes scurvy.

Barnes and Hume[1] found commercial dried milk prepared by Just Hatmaker process decidedly inferior to raw milk as an antiscorbutic. They believe that if infants are fed on dried milk preparations, some antiscorbutic should be added to the dietary.

Hess and Unger, however, found dried milk prepared by heating to 116° C. would prevent, and even cure, scurvy if given in sufficient quantities, in both experimental animals and infants. They state that an infant requires fully 1 pint of raw fresh milk a day to protect it from scurvy. If the milk is pasteurized, stale, heated a second time, or alkalized, more than 1 pint a day is needed. Babies fed on pasteurized milk should receive an antiscorbutic after the first few weeks of life.

Troup, of Christiana, is strongly of the opinion that scurvy is the result of a scorbutic element of the nature of a ptomaine present in the diet. Jackson and Vaughan Harley, as a result of an experimental inquiry into scurvy, arrived at much the same conclusion. The question under discussion here is whether or not infantile scurvy is the result of the *absence of some essential element in the diet* or the *presence of some scorbutic factor.* It is certain that an infant fed for a long period upon peptonized milk will develop scurvy, but if potato gruel and raw meat juice are added, yet no other alteration made in the diet and no medicine given, the scurvy will rapidly disappear and the child be well in a few weeks. Thus the addition of a fresh element containing antiscorbutic vitamine to the scurvy diet has cured the condition. Moreover, many of the diets, for example, oatmeal and water, upon which the young children become scorbutic, seem to exclude the possibilities of the development of ptomaines. The experiments of Jackson and Harley do not carry conviction that true scurvy has been produced in animals, but rather that a condition of ptomaine poisoning has resulted. It is possible that unsound food may hasten the development of scurvy, but the evidence at present seems insufficient to invalidate the conclusion that infantile scurvy is due to the absence of an antiscorbutic element rather than to the presence of some scorbutic poison.

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[1] Barnes, H. K., and Hume, E. M.: Lancet, 2: 323, Aug. 23, 1919.

Zilva[1] found that bubbling air through an antiscorbutic solution inactivated it, while the same solution boiled in an atmosphere of CO_2 for two hours showed no inactivation. It is evident that in considering the effect of heat on the antiscorbutic element the factor of aëration during the process of heating must receive more attention.

Hess[2] reports a case of scurvy developing in an infant fed on malt soup and cereal. His investigation of this case convinced him that alkalization especially if combined with heating destroys the antiscorbutic property of milk, and suggests that by the addition of alkaline proprietary foods to milk, the antiscorbutic value of the food is destroyed.

Faber[3] also reports a case of scurvy occurring in an infant fed on modified milk formula for which raw certified milk had always been used. Sodium citrate in small quantities had been added to the milk, and he believes that the consequent alkalization had partly destroyed the antiscorbutic factor. He believes that where it is desirable to alter the coagulability of milk, sodium citrate and other mineral salts should be regarded with distrust and other substances, such as barley water, used instead.

McClendon found that cereal grains, sprouted until the acrospire projects ½ inch beyond the grain, are rich in antiscorbutic substances. He claims that to prepare a malt extract that is an effective antiscorbutic the grain must be allowed to sprout to a more advanced stage than is necessary for the development of diastase, and the green malt must be crushed between rolls that thoroughly break up the acrospire. Commercial malt extract is deficient in the antiscorbutic vitamine as a rule, because the grain is not sufficiently germinated.

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[1] Zilva, S. S.: Lancet, 1: 17, Jan. 4, 1919.

[2] Hess, A. F.: New York State Jour. of Med., 20: 209, July, 1920.

[3] Faber, H. K.: Jour. Biol. Chem., 43: 113, Aug., 1920.

Gerstenberger reports three cases of infantile scurvy cured by the administration of malt soup extract. Gerstenberger admits that malt soup extracts are ordinarily deficient in the antiscorbutic vitamine, and suggests that antiscorbutic potency of this particular extract was due to the fact that the grain from which it was prepared had developed to the proper age and stage of germination to develop antiscorbutic properties. If this conclusion, agreeing with McClendon's findings, is correct all malt extracts might be manufactured from grain at such a stage of germination as to insure an adequate antiscorbutic content.

Summary of Essential Conditions.—The six essential conditions to be observed in the diet of infants are these:—

1. The food must contain the different elements in the proportions which obtain in human milk, viz.:—

Protein	1.5 per cent.
Fat	3.5 per cent.
Carbohydrate	6.5 per cent.
Salts	0.2 per cent.
Other constituents	0.6 per cent.
Water	87.7 per cent.
	100.00

2. It must possess the antiscorbutic vitamine.

3. The total quantity in twenty-four hours must be such as to represent the nutritive value of 1 to 3 pints of human milk, according to age, viz.:—

Protein	225 to 675 grains.
Fat	231 to 693 grains.
Carbohydrates	613 to 1839 grains.

4. It must not be purely vegetable, but must contain a large proportion of animal matter.

5. It must be in a form suited to the physiological condition of the digestive function in infancy.

6. It must be fresh and sound, free from all taint of sourness or decomposition.

Pathology.—Hemorrhages in and around the joints and in the muscles are found post-mortem. The most important point, however, is the presence of subperiosteal hemorrhage involving the long bones. Rotch states that the femora are the most commonly affected, and that there is a tendency to a separation of the epiphyses. Interstitial hemorrhage involving the lungs, spleen, kidneys, and interstitial glands has been found. When the kidneys are involved we can usually find hematuria. Hemorrhages are frequently present in the mucous surfaces; thus, the gums show a deep purple color, besides being swollen and presenting the characteristic spongy appearance.

We are indebted to Barlow for his valuable studies regarding the pathology and symptomatology of this disease. The blood shows no specific changes which are pathognomonic to this disease.

X-ray.—In regard to the radiographic picture, Porter[1] says that in the early stages the radiographic picture shows little more than subperiosteal hemorrhages. This is followed by proliferation of bone tissue, and if the hemorrhage has been profuse there is subperiosteal new bone formation. The white line of Frankel is also seen in the more advanced stages.

Baetjer says that in scurvy the epiphyseal line is intact, and the changes take place in the bone behind it. Periostitis and subperiosteal hemorrhages are the characteristic lesions. In both rickets and syphilis the epiphyseal line is involved.

Bacteriology.—No specific bacterium has as yet been found nor does the blood show any peculiarities bacteriologically.

Symptoms and Diagnosis.—The symptoms are marked irritability by day and restlessness at night, associated with insomnia. The mother or nurse will usually say that the child cannot be satisfied and cries whenever touched, most especially when the arms and legs are moved. It is very apparent that there is pain due to a swelling of the limbs, usually of the diaphyses just below the epiphyses. When not disturbed these children seem to lie quietly. Swelling of the limbs in the legs and forearm is usually present. While the skin over the swelling is tense there is no evidence of fluctuation. Tenderness on pressure is usually noted. Bluish-black spots, due to small subcutaneous hemorrhages, are visible. When hemorrhages affect the deeper parts around the eyes so that the eye itself will be pushed forward, a condition called proptosis will be noted. This condition of proptosis is found in advanced cases of scurvy.

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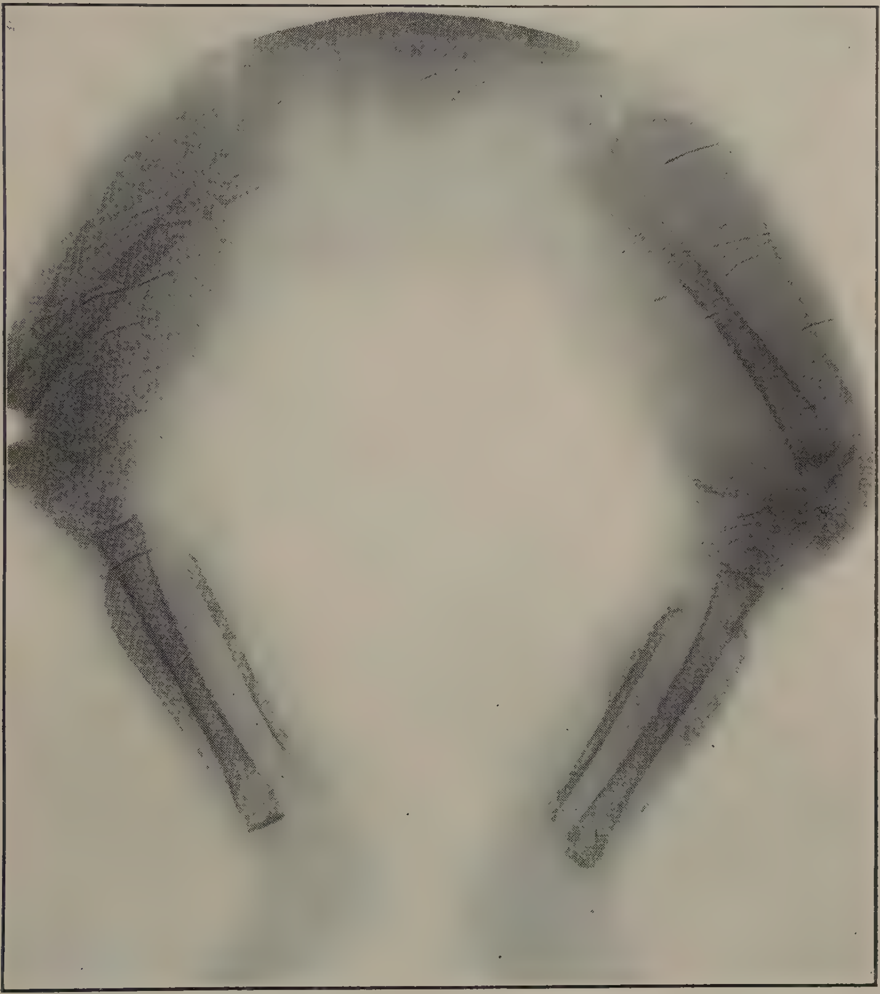
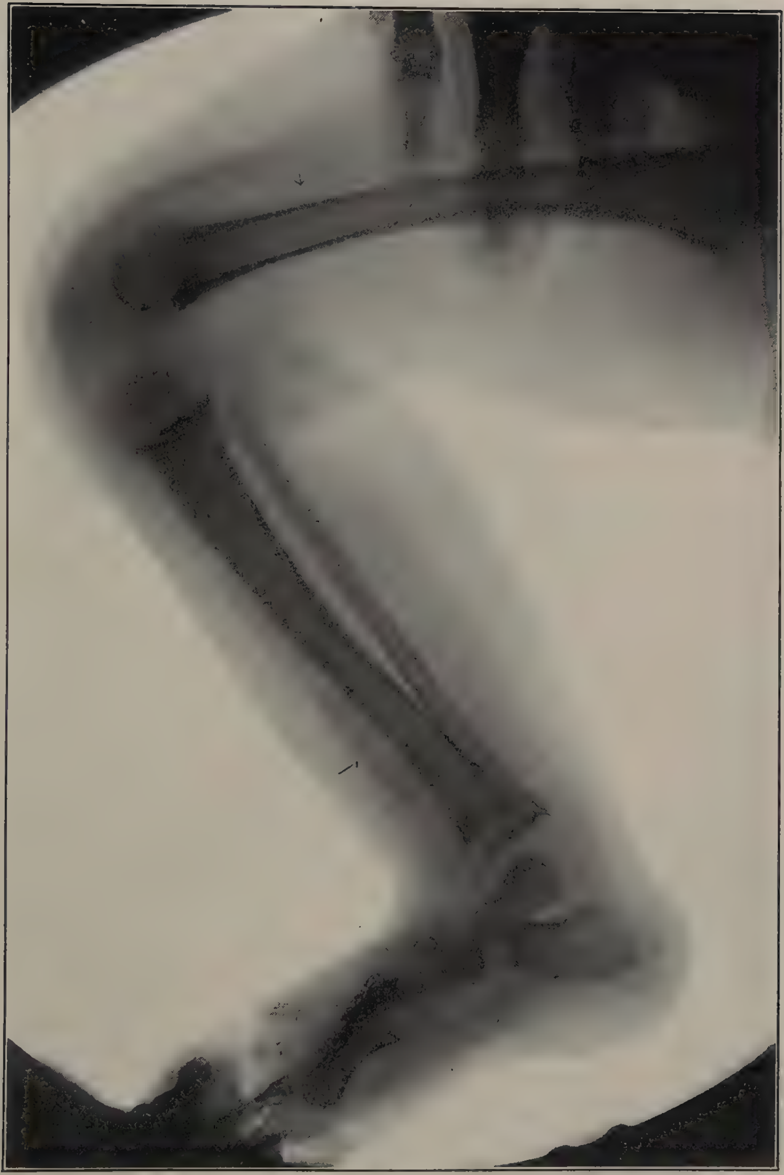
[1] Porter, L.: Calif. State Jour. Med., 17:431, Dec., 1919.

PLATE XXI



Scurvy. Subperiosteal hemorrhages. Unusually severe extravasations.
Infant nine months old. (Courtesy of *A. George.*)

PLATE XXII



Scurvy. Note subperiosteal hemorrhages with periosteal elevation and organization of clot at lower end of tibia and femur.

When children have walked, and suddenly stop walking, attention should be directed to the state of the gums and to the general physical condition. Such cases are usually suspicious, and may show the beginning of scurvy. Indeed, such symptoms will develop long before there is a general break-down. Emaciation and anorexia follow, which are associated in this condition.

Case I.—Joe W., 13 months old. The infant was bottle fed from birth. He was given condensed milk the first month and later, for a period of seven months, received Borden's malted milk. He was then put on cows' milk, which disagreed. The infant had mucous stools, which were streaked with blood. His general development was fair, although a bronzed condition of the skin existed. He had the first tooth when 4 months old, and was able to stand on his feet several weeks, until four weeks ago. It was then noted that he suddenly refused to stand, and that the slightest handling of the joints of his arms and legs produced severe pains. A diagnosis of articular rheumatism was made.

There was marked tenderness over the joints. The head perspired freely when food was taken. The gums were soft and tender, and had a bluish-red ridge around the teeth. The weight at the age of 13 months was 12½ pounds, which in itself is sufficient to show faulty metabolism. There was a marked rachitic rosary, and beaded ribs on both sides, so that the diagnosis of scurvy and rickets was warranted.

The sudden onset of symptoms made the case resemble a form of infantile paralysis. When the symptoms are associated with the bleeding gums, the purplish, spongy swellings, and the bluish-black, subcutaneous hemorrhages visible on the inside of the cheek, then the diagnosis of pseudoparalysis associated with scorbutus must be made.

Differential Diagnosis.—*From Rickets:* This condition is easily differentiated. In scurvy there is no rachitic rosary. There are no hemorrhages involving the gums nor spongy swellings found in rickets. The pendulous belly is not seen in scurvy, neither is the rachitic, square head.

From Tuberculosis.—The absence of cough and other physical signs in the lungs, besides the absence of the symptoms above mentioned common to scurvy, will differentiate this condition from tuberculosis.

Scurvy and Rickets.—Both diseases may be found at the same time in the child, and are evidently due to disturbances of metabolism founded upon the dietetic errors in the absence of the live factors in food.

Prognosis and Course.—The course of the disease is usually chronic. The outcome depends on the rapidity with which vitality can be restored. A decided change in the mode of living, the food, and the hygienic conditions must be continued for many months after improvement has been noted. Unless we persist with treatment relapses will occur.

Owing to pain in the limbs the child does not appear to move, giving rise to the impression that the child is paralyzed. When this condition is seen in scurvy it has been called pseudoparalysis. The gums are very spongy and swollen, and have bluish maculæ over the surfaces. The child shows evidences of marked anemia and loss of weight. There is loss of appetite, and when food is taken the head perspires freely. The temperature rises in the evening to between 100° and 101° F. The pulse is small, feeble, and ranges between 120 and 140. The respirations are not affected. The clinical picture is one of marked malnutrition with symptoms simulating tuberculosis.

Arbman[1] notes that slight hematuria is a very early symptom of infantile scurvy, and that a microscopical examination of the urine may be of great value in diagnosis.

Porter points out that the subacute type of infantile scurvy is more frequent than is commonly supposed. The child is "fussy" and cries when taken up; there is usually no swelling of the epiphyses, but a history of easy bruising, and possibly hemorrhagic spots somewhere on the body. There is some tenderness in the bones, and often hematuria.

An investigation of the method of feeding will usually show that the child has been fed on overheated food. The symptoms will clear up promptly if the child is given suitable antiscorbutic diet. This is a therapeutic test that can be easily applied, is perfectly harmless, and will often clear up suspicious cases.

Treatment.—Scurvy can be cured by giving raw milk, fresh orange, lemon or tomato juice; still we find that a great many clinicians persist in prescribing sterilized milk until either rickets or scurvy is established. *It was for this reason that at a discussion on infant feeding at the Academy of Medicine, October, 18, 1900, I advised the use of raw milk as the proper means of feeding children to prevent scurvy.*

The following case of scurvy will serve to illustrate the condition:—

Case II.—A child 13 months old was brought to me with a history of being very restless and having lost considerable weight. The child showed a shriveled appearance of the skin; its normal elasticity was gone; the skin was dry; the thorax was pigeon-breasted; the arms and legs were thin; both arms and legs showed marked tenderness on the slightest motion; there was baldness at the occiput, and the anterior fontanel was not closed; the child had eight teeth, all of which were slightly carious; the gums around the teeth were deeply congested and showed bluish ridges; the gums were spongy and bled very easily; there was an intense fetor to the breath; the child had been suffering from diarrhea for the past two months, with occasional periods of constipation; there was no vomiting; the appetite had always been very poor. The previous history of the child was that, when born, it weighed about 5 pounds. The mother of the child died during confinement, and hence the baby was given into the care of a nursery. The diet consisted of 1 teaspoonful of condensed milk with 12 teaspoonfuls of water and a small pinch of sugar. This was fed every two hours for a period of over two months; later the child was put on barley water, to which some condensed milk was added. This was changed from time to time to a diet of oatmeal water and condensed milk.

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[1] Arbman, J.: Infantile Scurvy. Archives of Pediatrics, 38: 41, Jan., 1921.

The child had always been frail, and had a cough and also an attack of acute capillary bronchitis; during the summer the child had a severe attack of cholera infantum, and almost lost its life from vomiting and purging. For one month this child subsisted on a diet of oatmeal water, rice water, farina water, and albumin water, besides cold tea. Thus it is seen that the child received no milk for a period of over seven weeks. When the child was 5 months old it weighed 7 pounds, and at the time of writing it hardly weighs 10 pounds. There was a marked rachitic kyphosis; the ribs were beaded; there is a pendulous belly; the child had an umbilical hernia; the temperature, taken in the rectum at 2 P.M. for a period of at least two weeks, was no higher than 100° to 101° F.; there was intense thirst; the kidneys were very active; the urine had a very high color; no hematuria could be found.

The diagnosis of infantile scurvy was made, and the child was put on the following treatment: Orange juice; lemonade; freshly expressed steak juice; raw milk, diluted with barley water or rice water, equal parts (4 ounces of milk, 4 ounces of barley water), repeated every three or four hours, depending upon the appetite. Massage of the body was very gently performed with codliver oil or vaseline, to lubricate and to nourish. A 1-drop dose of nux vomica was ordered before each feeding. This treatment was given continually for three or four weeks. Every fourth or fifth day a half-ounce of barley water or rice water was withdrawn, and instead an equal quantity of fresh milk was added; hence, after four weeks of treatment this child received 6 ounces of milk with 2 ounces of barley water or rice water every four hours.

The child was sent to the seashore, and after this treatment was continued for seven months all symptoms of scurvy had disappeared; the child recovered.

The most important part of the treatment of scurvy consists in prescribing the antiscorbutic elements by proper feeding.

Dietetic Treatment.—Antiscorbutic diet consists of fresh milk, fine potato gruel,[1] raw meat, cabbage juice, raw yolk of egg, orange or lemon juice, and sugar.

Fresh milk is clearly not a potent antiscorbutic, and, although sufficient to prevent scurvy when given in full quantity, will not always prevent it when taken in small amounts only. It fails accordingly to remove the scorbutic condition with quickness and certainty when given alone. It is necessary, therefore, to add to the food some more active agent, such as potatoes, carrots, or cabbage juice, or orange juice, or a broth in which vegetables, such as carrots and potatoes, have been boiled and strained, with raw meat juice in addition.

In addition to the rigid enforcement of the above-mentioned foods, we must insist upon fresh air.

Chick and Rhodes found raw swede juice to be the most potent of all vegetable juices that might be included in an infant's diet. Its antiscorbutic value approximated that of orange juice.

Medicinal Treatment.—Restoratives such as codliver oil, with or without the hypophosphite of lime or soda; iron, arsenic, and strychnine are the most valuable in this condition. The lime salts are indicated; 3 to 5 grains of calcium lactate may be given three times a day. Excellent results can be obtained from the use of soluble forms of iron. Fowler's solution should be ordered after each meal.

When recurring hemorrhages are noted, an injection of 10 to 15 cubic centimeters, or about 4 drams, of sterile horse serum should be given. This will frequently be followed by a rapid disappearance of the bluish spots.

Hess and Unger used boiled and neutralized,—or slightly alkalinized orange-juice intravenously in three cases. The children showed no untoward reaction, and the improvement was marked. Only a few cubic centimeters were used at first, the dosage being gradually increased until 30 cubic centimeters is used at one time. In one case a total of 68 cubic centimeters was given in six injections; in the second case, a total of 87.5 cubic centimeters in eight injections; in the third case a total of 60 cubic centimeters in four injections.

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[1] Prepared by rubbing thoroughly steamed floury potato through a fine sieve, and beating this up well with milk until it is smooth and of the consistency of thin cream. A teaspoonful of this may be added to each bottle at first, and the amount gradually increased to a dessertspoonful, if it is found to agree. Well-boiled carrots may be used in the same way.

Hygienic Treatment.—Besides having fresh air, a child suffering with scurvy must be put directly into the sun. This sun bath should be administered daily, but, owing to the delicate nature of the skin, precautions must be used against scorching the same. Some children can stand no more than fifteen minutes' exposure to the sun's rays, while others will not scorch though exposed for an hour. Proper ventilation of the sleeping apartment is very important. A scorbutic child requires a daily bath consisting of one pound of salt to a tub of water at a temperature of 95° F. The child should be bathed from three to five minutes and rubbed briskly while in the tub. After the bath the body should be dried with a coarse towel and rubbed until the skin has a pinkish color. This friction or massage is very invigorating, and if done in the evening it will promote sleep and soothe the child.

RACHITIS (RICKETS).

Rickets is a disorder of nutrition. It occurs chiefly between the ages of 6 months and 2 years. Congenital rickets is occasionally seen. It affects the bones primarily, and can be very readily distinguished during life. The disease also affects the ligaments, the mucous membrane, the muscles, and especially the nervous system.

Pathology.—The lesions are chiefly noticed in the bones, although the soft tissues show evidences of anemia. The primary lesion is hyperemia of the periosteum, the marrow, the cartilage, and the bone. The spleen and liver are usually enlarged. Frequently we note enlargement of the lymphatic glands.

Starck found the spleen enlarged in 60 per cent. of his autopsies in rachitic children, and in 68 per cent. of all his living cases. In the kidneys there are usually no pathological lesions. The cartilage cells of the epiphyses undergo increased proliferation from four to ten times more than they do in a normal growing bone. The matrix is softer; as a result the bone formed from this abnormal cartilage lacks firmness and rigidity.

The increased proliferation of cells makes the epiphysis larger, swollen in appearance, irregular in outline, and much softer in consistence. It has been experimentally proven that hyperemia of bone causes defective decompositions of lime salts. Owing to this deficiency of lime salts the bones become very soft and flexible. While normally there is two-thirds mineral matter in the bones, in rickets this is reduced to one-third. Thus we can easily explain the various "rachitic deformities" which are especially noted in the femur, the tibia, the radius, the ulna, and the ribs. When ossification is retarded during rickets, as, for example, in the parieto-occipital region, the bone is frequently so thin that it yields to pressure; this is called craniotabes.

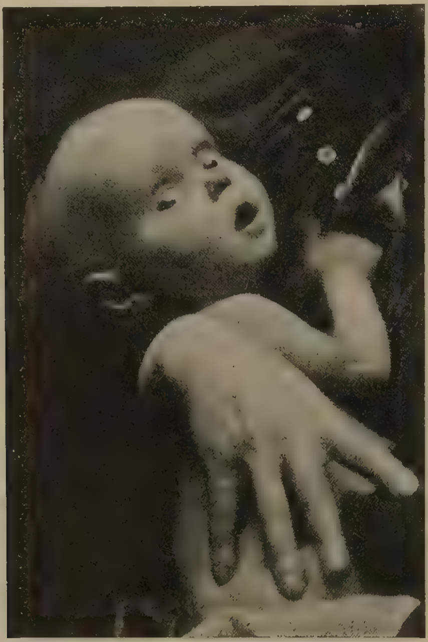

Fig. 83.—Hydrencephaloid (spurious hydrocephalus). Infant 8 months old. Bottle-fed. Suffering with cholera infantum. Severe nervous and toxic symptoms.

The fontanels are not closed until very late, owing to this delayed ossification. The frontal and parietal protuberances are very much enlarged, due to exaggerated proliferation of the periosteum, so that the head acquires a broad forehead with characteristic frontal prominence. This condition is frequently taken for hydrocephalus. When ossification takes place the bones become large, heavy, and irregular in outline, corresponding to the clinical manifestations known as "bow-legs," "knock-knees," "pigeon-breast," "spinal curvature," and "square cranium."

Where the bone joins the cartilage, as, for example, on the ribs, enlargements occur which simulate beads; hence the term "beaded ribs," also called "rachitic rosary." The same enlargements can be felt at the wrists, ankles, and knees.

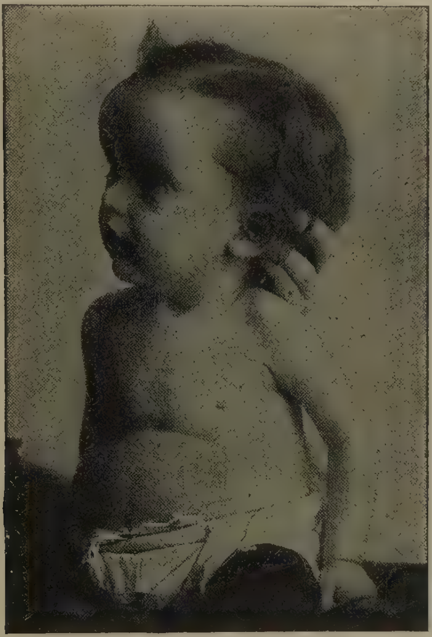

Fig. 84.—Same child two years later. Note the square head, the frontal protuberance. Also the Harrison groove and the pendulous belly.

A *section* through the epiphyseal junction of a rachitic bone shows a very vascular, bluish-colored condition, which is softer than normal when cut. In the shaft next to the periosteum the bone is soft and thickened, but deeper it is hard. Sections through thickened masses on the flat bones show a spongy, vascular substance which is soft enough to be indented easily.

Microscopical examination shows a marked increase in new cartilage cells and increased vascularity of the proliferating zone. The areas which should be calcified show large quantities of cartilaginous tissue instead. The underlayer of the periosteum is very vascular, and again there is a great excess of uncalcified cartilage. In the flat bones the bony trabeculæ are eroded, and their places taken by newly formed minute blood-vessels.

When the rachitic process ceases and recovery begins, this excessive proliferation stops. Calcification and ossification of these tissues take place; the enlargements due to the hyperplasia are absorbed, and the bone returns to a normal condition save for any deformities that may have resulted during the activity of the rachitic process.

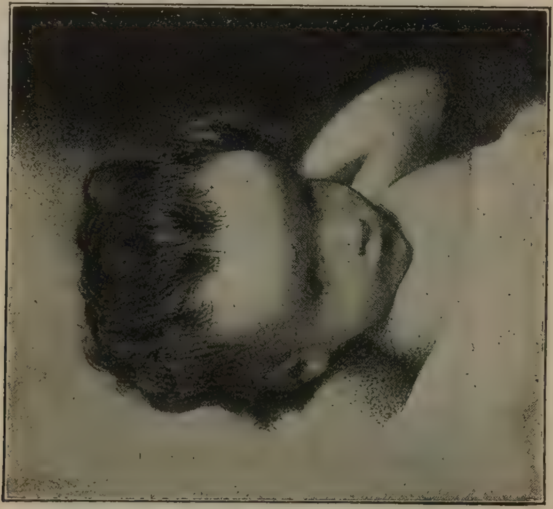

Fig. 85.—Spurious hydrocephalus, illustrating marked frontal and parietal protuberances. There was a striking resemblance to a case of hydrocephalus. Bottle-fed. Rachitic.

Etiology.—Children that have suffered prolonged diarrheas or with severe diseases—like dysentery, typhoid, bronchitis, and pneumonia—are prone to the development of rickets. Children of syphilitic parents and those whose parents are tuberculous are more prone to the development of this disease. Von Ritter found that, in 27 cases out of 71 examined by him, rickets was not only found in the children, but as well in the mothers of these same cases. Thus it is that Kassowitz and Schwarz[1] have mentioned the existence of congenital rickets. These same authors found that 80 per cent. of children born in the Vienna

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[1] Wiener medicinische Jahrbucher, vol. viii.

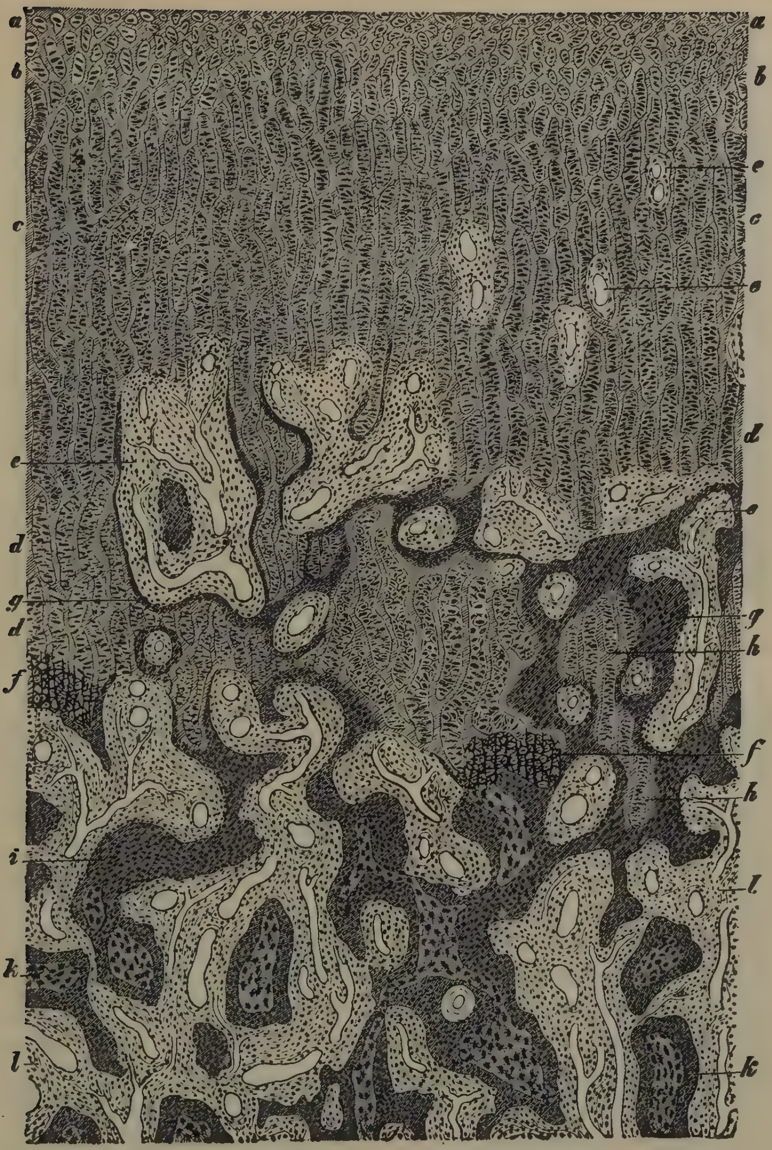

Fig. 86.—Rickets. Longitudinal section through the ossification junction of the upper diaphyseal end of the femur of a 1 year old child suffering from rachitis of moderate degree. *a,* Unaltered hyaline cartilage. *b,* Cartilage in the first stage of proliferation. *c,* Zone of proliferated cartilage cell columns. *d,* Columns of proliferated hypertrophic cells. *e,* Vessels located in the cartilage, with fibrous marrow tissue. *f,* Decalcified cartilage tissue. *g,* Osteoid tissue. *h,* Remains of cartilage tissue in osteoid tissue. *i,* Trabeculæ of decalcified osteoid tissue. *k,* Trabeculæ of osteoid and fully formed calcified bone tissue. *l,* Fibro-cellular marrow tissue. (*Ziegler.*)

Lying-in Hospital were rachitic. This statement is not so easily accepted, for neither Baginsky nor Virchow accept the same Experimentally, it has been found as long ago as 1842 by Chossat that when lime is deducted from the nourishment of young animals not only soft bones result, but they finally die. Heitzmann maintains that, if lactic acid is introduced into the food of young animals, the result will be, first, rickets, and, later on, osteomalacia will result therefrom.

The bones show the most characteristic result of improper nutrition for they are very soft and spongy. They will yield to the weight of the body if used in walking, and thus it is that bow-legs with extensive curvatures form such a prominent feature showing the result of using soft bones.

The absence of human milk from the diet of an infant is one of the prime reasons for the development of rickets. We therefore find more than 90 per cent. of all cases of rickets among bottle-fed babies. Other contributing factors are the absence of sunshine and the crowding of large families into small rooms having poor ventilation. Rickets will occasionally be seen in the breast-fed child under similar conditions. If the mother while nursing suffers with malnutrition, malaria, chronic cough, or with any organic lesion which devitalizes her body, then poor breast-mik deficient in its nutritive elements will cause the baby to be underfed and finally result in rickets.

Sherman and Pappenheimer[1] have come to the conclusion that lesions resembling rickets may be caused or prevented without change in either the protein or the vitamine component of the diet and that therefore neither of these can be regarded as a necessary predominating factor. Phosphorus was found to be the element in whose presence rickets was prevented and in whose absence it appeared regardless of the remainder of the diet. They believe that it is the quantitative relations of the inorganic ions rather than an absolute deficiency of any one of them that may be the determining factor. They further believe that an unbalanced quantitative relationship of organic as well as inorganic food elements has a bearing on the etiology.

Shipley, Park MacCullum and Simmonds[2] likewise believe

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[1] SHERMAN and PAPPENHEIMER: Proc. Soc. Exper. Biol. and Med., 18: 193, March, 1921.

[2] SHIPLEY, PARK, MACCULLUM, and SIMMONDS: Bulletin Johns Hopkins Hosp., 32: 160, May, 1921.

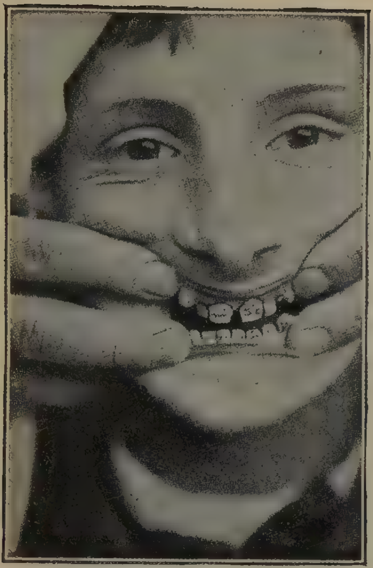


Fig. 87.

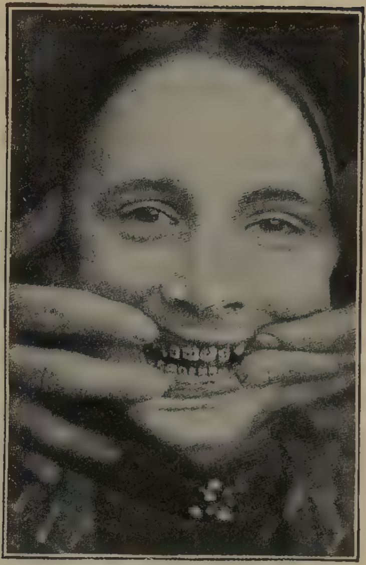


Fig. 88.

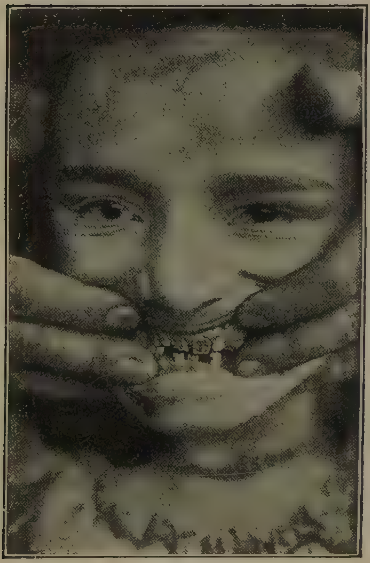


Fig. 89.

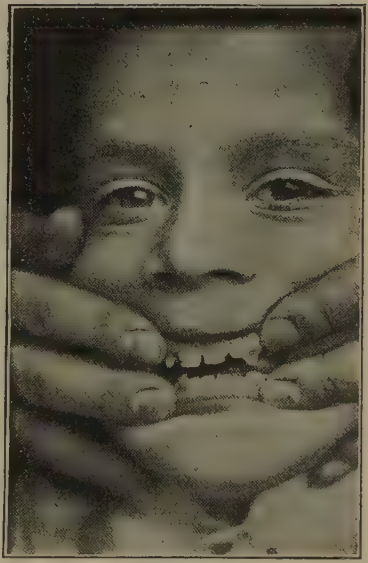


Fig. 90.

Illustrating rachitic erosions of the permanent teeth (*Neumann*).

that the phosphorus ion is the factor which determines the development or prevention of rickets. These investigators assert that a deficiency of fat-soluble vitamine "A" is not in itself sufficient to cause rickets, provided that the phosphorus content of a diet is sufficiently high. It therefore seems probable that rickets is due to several factors rather than to one deficiency in the diet.

Fig. 92

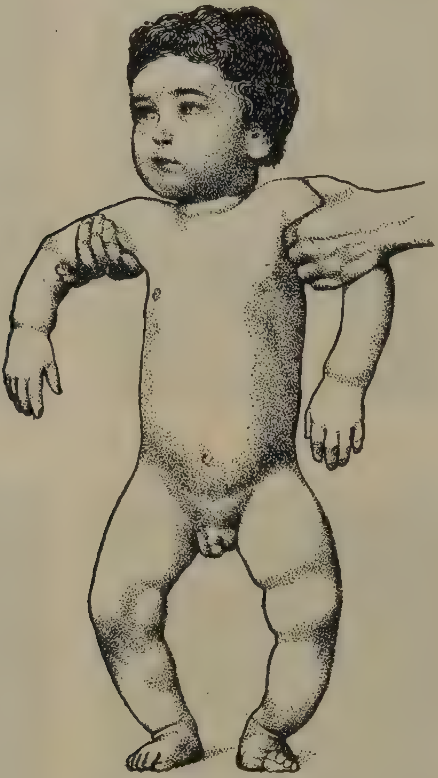


Fig. 91

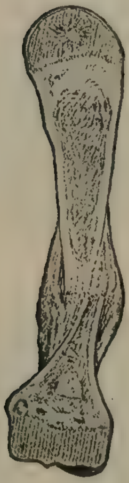


Fig. 91.—Five-week-old fracture of the humerus, in a rachitic child 1½ years old. (*Langerhans.*)

Fig. 92.—A severe type of rickets with enlargement of both condyles of the femur. There is also enlargement of the upper epiphyses of the tibia and fibula. The illustration also shows enlargement of the epiphyses of the ankles. An anteroposterior curvature (giving the bowleg appearance) is plainly seen. Note also the enlarged epiphyses of the radius and ulna. Drawn from a photograph.

Symptoms.—One of the earliest symptoms noted is constipation. Head sweating while feeding, especially at night, is an early symptom of rickets. Rolling of the head on the pillow, with occipital baldness, pallor of the skin, and profound anemia, frequently precede or accompany the development of rickets. Rachitic changes affect the fontanel and the sutures, as well as all the bones of the cranium. The rhombic form assumes an irregular outline. The sutures, especially the lambdoidal and frontal, are distended.

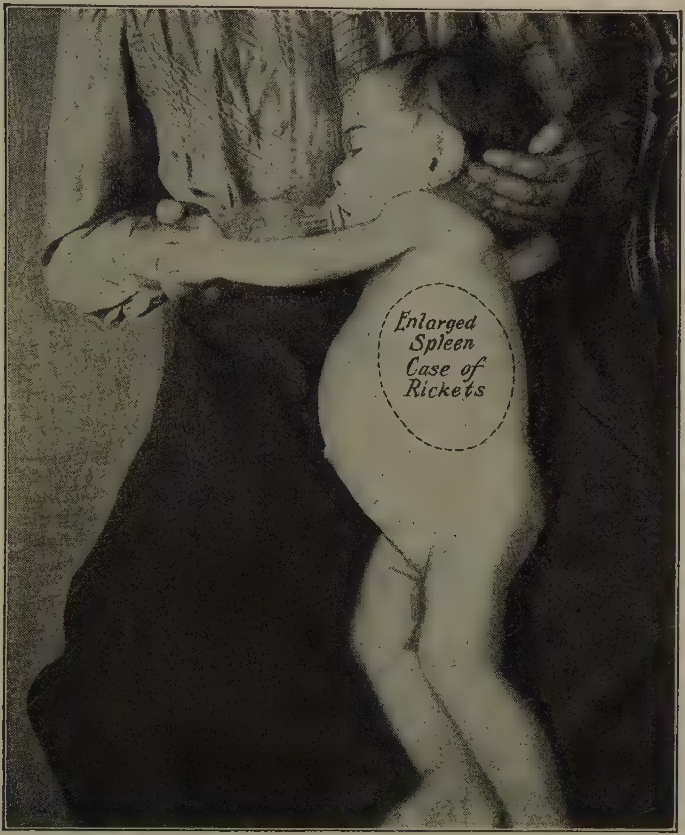


Fig. 93.—Case of rickets showing enlarged spleen; also pendulous belly.

The fontanel remains open much longer than in normal infants, so that not infrequently the anterior fontanel can still be felt slightly open as late as the third or fourth year of life. Although the usual type of rachitic head is square, not infrequently it assumes an asymmetrical form.

We are indebted to Elsässer for a description of one of the most valuable symptoms in rickets, namely, "softening of the cranial bones," known as "craniotabes." Small areas of softened bone which will yield on the slightest pressure can be felt in the region of the lambdoidal suture.

Early symptoms of rickets also are tetanic seizures, muscular spasms, and laryngeal spasms. Dentition is delayed, the teeth appearing irregularly, and in older children they are carious. Not infrequently we find no evidence of teeth until the child is 16 or 18 months old. Rachitic symptoms appear later in the thorax than in the head, although they can be plainly made out during the first six months. Beaded ribs are especially prominent in advanced cases. There is a marked *depression of the thorax* in a line parallel with and on either side of the sternum. This line corresponds with the course of the beads. The so-called pigeon-breast or funnel-breast (pectus carinatum) is frequently observed in rickets.

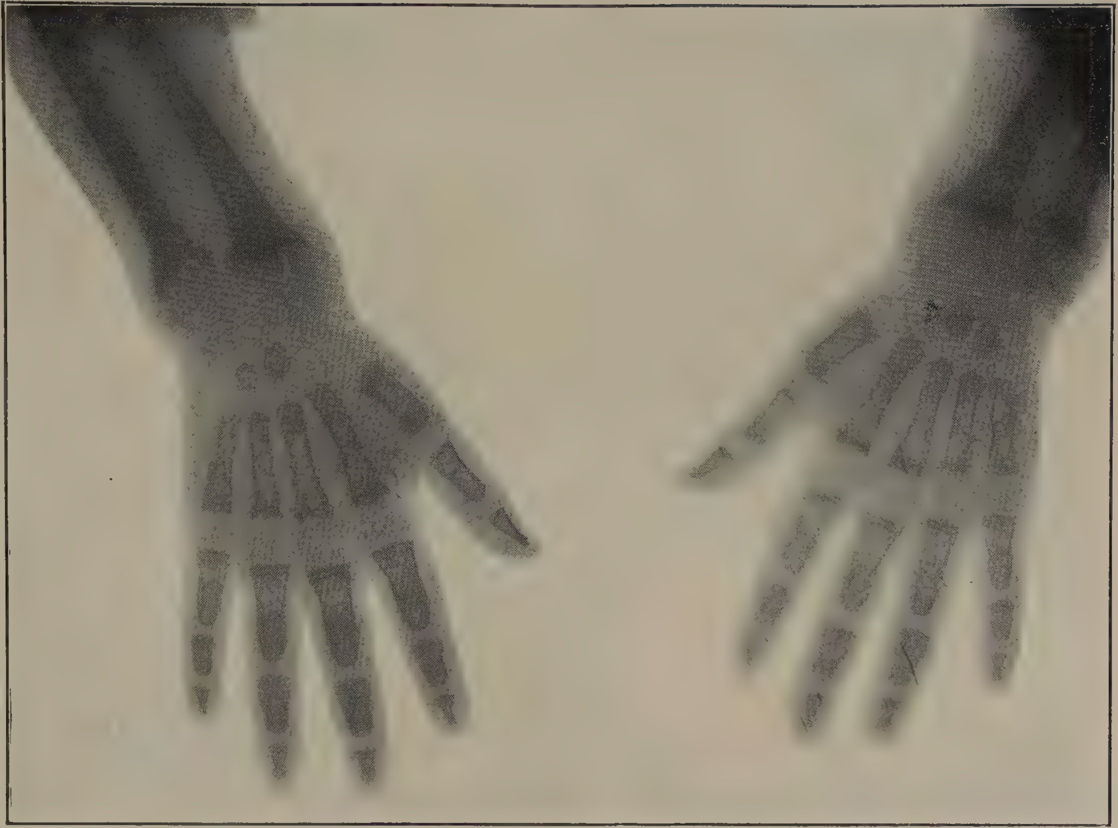
The veins of the scalp are usually enlarged. Spinal rickets is especially characteristic. The posterior curve of the spine is commonly known as rachitic kyphosis. It extends from the middle-dorsal to the sacral region.

This kyphosis has been found in more than one-half of my cases. The curve can be lessened or it will disappear when the child is placed on its back and extension is made on the extremities. The more important rachitic deformities are:—

1. Rachitic kyphosis.
2. Rachitic scoliosis.
3. Chicken (or pigeon) breast.
4. The rachitic pelvis.
5. Cubitus valgus or varus.
6. Distortion of the lower extremities:—
    (*a*) Genu varum.
    (*b*) Genu valgum.
    (*c*) Anterior curvature of the tibiæ.
    (*d*) General distortions of the lower limbs.

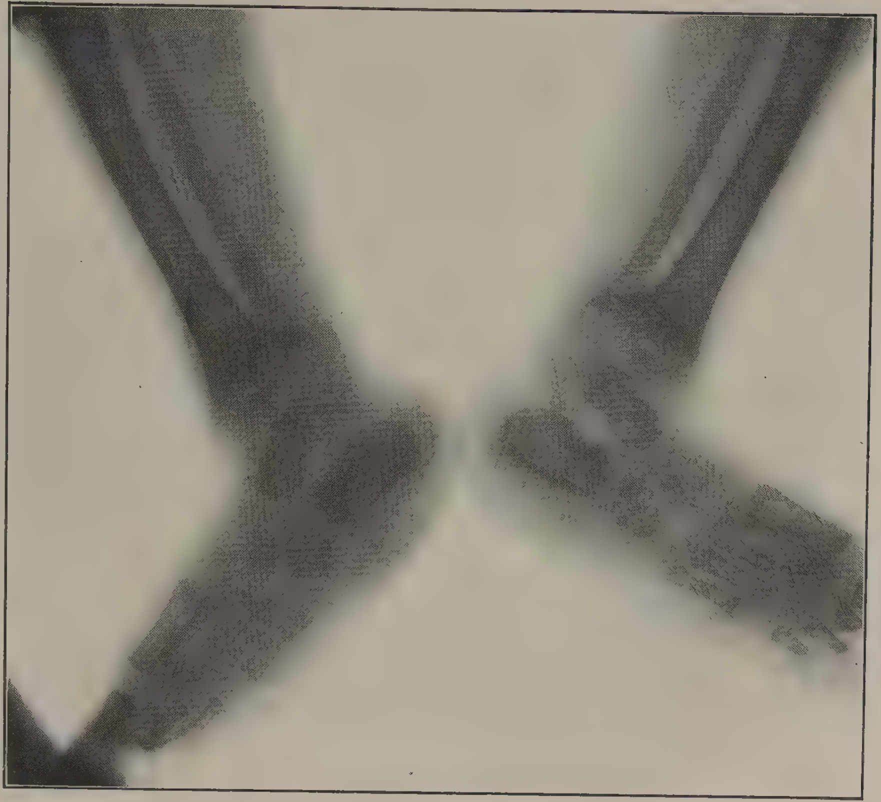
Diastasis of the Recti Muscles in Rickets.—When the muscles lose their tone, we frequently have the bony changes soon afterward. Diastasis of the recti muscles of one-half or one inch can sometimes be made out. To properly examine a child for this

PLATE XXIII



Rickets. Note the flaring, cup-shaped, irregular termination of the diaphysis. Condition accounts for enlargement of wrists in rickets.

PLATE XXIV



Rickets. Note the flaring, cup shaped, irregular termination of the diaphysis. Condition accounts for enlargement of ankles in rickets.

condition it should be laid on its back with the head and shoulders elevated; thus the recti muscles will relax and a protrusion of the abdominal contents in the median line can be noted.

The clavicle is affected only in severe cases.

Extremities.—It is not difficult to note deformities in the humerus. The epiphyses, as in all long bones, are thickened and enlarged. The thickening of the epiphyses in the radius and ulna is readily made out. The shaft of these bones describe a convexity upon their extensor surface. Green-stick fractures are very common in these bones. The ends of the metacarpals or of the phalanges are sometimes enlarged.

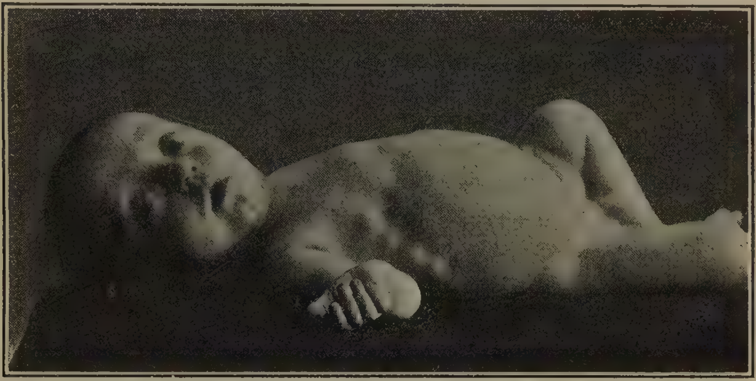


Fig. 94.—Rickets, showing beaded ribs and an enlarged pendulous belly. Mouth-breathing due to adenoids. Breast-fed infant. Always lived in tenement house district. Mother very anemic.

The Lower Extremities.—The outward bend of the tibia and, in marked cases, of the femur produce the condition known as bow-legs (genu varum). (Fig. 92.) In these cases when the feet are put together the knees are far apart. The opposite condition known as knock-knee (genu valgum) may exist. The inner condyles of the femur are hypertrophied, so that when the knees are put together the feet are far apart. Knock-knees are more common in females. The ligaments around the joints are relaxed and weakened, so that from an anatomical standpoint they assist in producing this deformity. The muscles show marked evidences of this disease. They are flabby, soft, and small with poor development. This accounts for the late age at which these children begin to walk. The muscular power is very feeble, and not infrequently paralysis will be suspected when really we are dealing with aggravated rachitic muscles.

Malnutrition is plainly made out on studying those emaciated, anemic children whose bones are markedly rachitic. On the other hand, we frequently find very fat children with extreme pallor showing marked rickets. Therefore, a *fat infant is not necessarily a healthy infant.* The abdomen is enlarged and usually tympanitic on percussion. It is commonly known as the "pendulous belly." This latter symptom I meet with in fully 90 per cent. of my cases in a large children's service extending over many thousand cases. The loss of tone in the abdominal muscles, and especially in the muscular walls of the stomach and intestines, is one of the prime reasons for constipation. Occasionally the reverse may be true and diarrhea may be noted. There is frequently marked distention of the stomach and colon. The stools are hard and dry, causing a chronic catarrh of the colon. We frequently find at the end of the stool a large amount of glairy mucus.

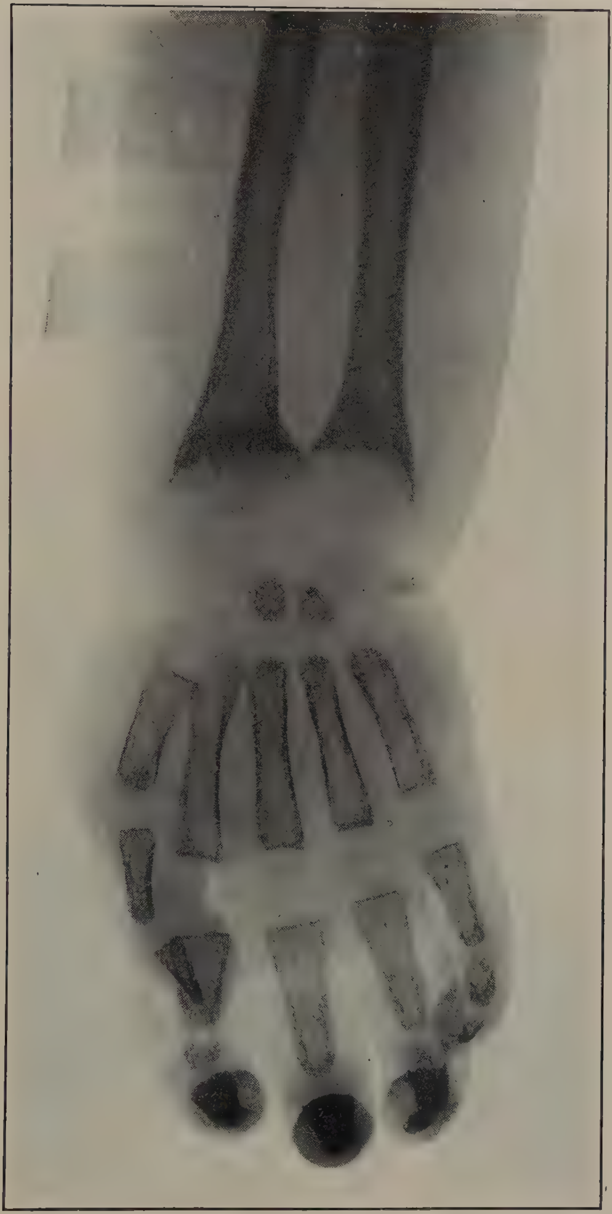
The pulse and temperature are normal. Occasionally a bruit can be heard over the anterior fontanel. It has no special significance. There is nothing characteristic in the urine in rickets. The blood has been studied by Morse, who concludes that anemia is present in most cases. Its intensity varies with the intensity of the rachitic process. Leucocytosis may or may not be present. An enlarged spleen is met with in these cases.

Convulsions and spasms of various descriptions occur frequently in rickets. There seems to be a predisposition to general tetany, and to laryngeal spasm (spasmophilia). The general weakness of the body is also seen in the marked tendency to irritation in the nerve centers. *Most diseases in rachitic children are ushered in with convulsions,* thus showing the extreme sensitiveness and susceptibility of the nerve centers. An overloaded stomach in a rachitic child under 1 year of age, suffering with high fever, is usually attended with hyperpyrexia and convulsions.

Diagnosis.—This is usually very easy. Head sweating, constipation, restlessness at night, delayed dentition without palpable osseous manifestations usually mean rickets. The most prominent symptoms are beaded ribs, enlargement of the epiphyses of the wrists and ankles, kyphosis of the spine, and bow-legs.

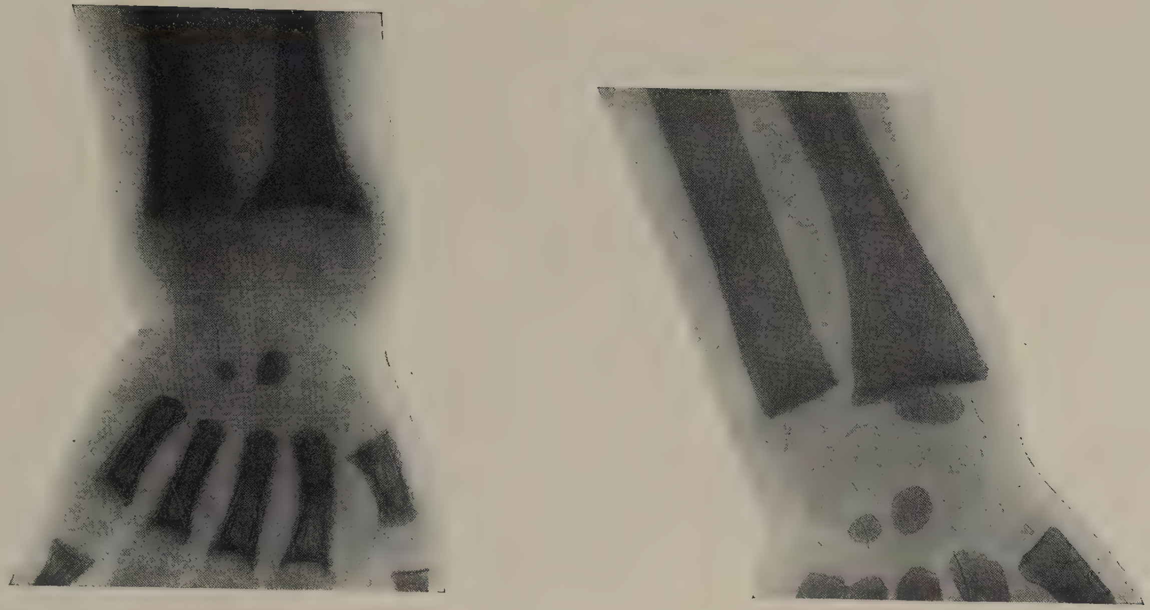
Differential Diagnosis.—The rachitic head is sometimes mistaken for hydrocephalus. The electrical reaction will decide whether or no we are dealing with a poliomyelitis, or if the case

PLATE XXV



Rickets. Showing typical cup-shaped excavations at the lower ends of the radius and ulna.

PLATE XXVI



The X-ray to the left shows the typical picture of rickets. The same wrist, three months later, after codliver oil therapy, showing a clearly outlined epiphyseal line, is pictured at the right.

is a pseudo-paralysis with rickets. We can differentiate the bony enlargements of syphilis from rickets with the aid of an x-ray. The *bony changes in syphilis affect the shaft of the bone* rather than the extremities. An important point to remember is that in syphilis there may be necrosis; this is never seen in rickets. The differential diagnosis will best be made by a blood examination for the presence of a Wassermann reaction. Scurvy is easily differentiated from rickets by the spongy condition of the gums, by the tendency to hemorrhage, and usually also by the presence of ecchymotic spots. The diagnosis of rachitic kyphosis from spinal tuberculosis (Pott's disease) is easily made, although I have seen one case in which there existed a rachitic kyphosis in a tuberculous child.

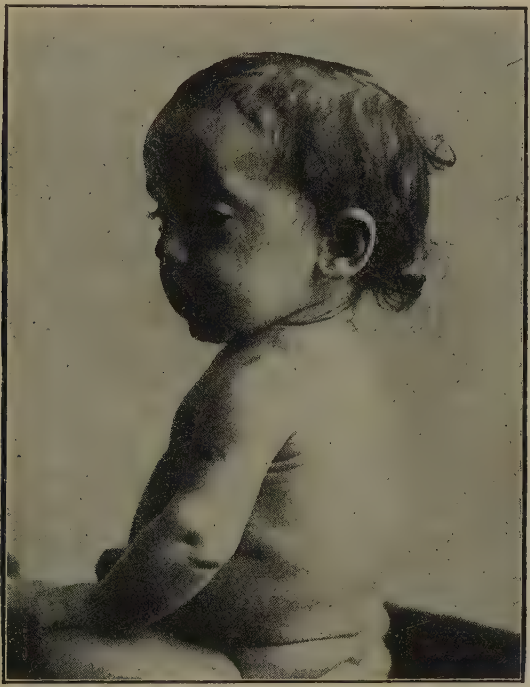


Fig. 95.—A very common type of rickets. Infant 19 months old having the development of a 9 months old baby. Three teeth. Cannot stand. Cannot talk. Overfeeding of carbohydrates. Has had no vegetables. The teeth show signs of decay. The head is large and square. There is a spinal curvature. The bones are soft and the muscles are flabby. Note the large pendulous abdomen.

Prognosis and Course.—Rickets, *per se,* is rarely fatal. The active symptoms exist about one or two years; in rare instances for many years. Damage of the system may remain throughout life. Spinal curvatures and thoracic deformities will remain for many years.

Rachitic children when attacked by infectious diseases suffer far more and the prognosis is graver than it would be otherwise. The abnormal condition of the thorax in rachitic children must always be taken into consideration in a child suffering with pneumonia, pleurisy, or other pulmonary conditions, in estimating the outcome of the disease.

Treatment.—*Hygienic Treatment:* When rachitic conditions are established the first thing to do is to insist upon removing such children to healthful surroundings. When children are housed in poorly ventilated homes, dark rooms, it is useless to give medicine until the unsanitary surroundings are improved. Successful treatment in such cases demands *plenty of sunshine,* open windows, night and day, a tub bath with a handful of sea salt added every day. After the bath good brisk rubbing to stimulate the circulation is very necessary. A change of air from the city to the country is desirable. When we are prescribing for the poor they should be instructed to remain in the park as much as possible. The establishment of *small roof gardens* on the tops of the highest dwelling or tenement houses makes a cheerful place for the rachitic children to play.

Dietetic Treatment.—Next to hygienic methods the care of the diet is important. If a nursing infant shows rachitic symptoms the chemical examination of the breast-milk should be made. If we find low proteins the nursing mother or wet-nurse should be given more meat, eggs, and cereals. If, however, conditions exist which prevent proper nursing, the child should be weaned. A properly modified cows' milk adapted for the age and development (see section on Nutrition) should be substituted. I insist on feeding such children with cereals, such as barley, rice, cream of wheat, sago, farina, etc., and giving them plenty of fresh vegetables, such as spinach, tomatoes, asparagus, peas, and beans. Eggs, white meats, and fish may be given if children are old enough. Fresh fruits must not be forgotten. Butter and cream are valuable adjuncts to the dietary.

Medicinal Treatment.—In addition to the importance of proper feeding we must seek to establish proper metabolism. All the emunctories must be carefully watched. Drug treatment should be directed to supplying the deficient amount of lime in the bones. The glycerophosphate of lime, which has been used by me for several years, in doses of 1 to 5 grains, three times a day, is very useful.

Howland and Park[1] have made extensive studies of the effect of codliver oil alone on rickets. Prompt healing was obtained with the formation of a double line in the juxta-epiphyseal region of the shaft and ossification of other rarefied areas of the bones. Careful comparisons should be made between the effects produced by phosphorus alone, codliver oil alone, and a combination of the two.

The method of action is little understood. In the case of codliver oil the result might be attributed to the presence of fat soluble "A" (vitamine), but this could not be the explanation for the action of phosphorus. There is a trace of phosphorus in codliver oil in organic combination, but it is improbable that it is present in sufficient quantity to exert any influence. Clearly, phosphorus and also codliver oil, in some way restore the power of normal ossification, which in rickets is temporarily lost. This refutes the contention of Wagner, who thought phosphorus incapable of assisting in ossification in rickets until some other factor restored the altered calcium metabolism to normal.[2]

Codliver oil, to which $\frac{1}{200}$ grain of phosphorus is added, has served me very well in some instances. This phosphorized codliver oil must be freshly prepared, as it deteriorates on standing. Hundreds of children in the crowded sections of the city have been put on the phosphorus treatment. When codliver oil *was added* to the phosphor, good results were noted, not otherwise; so that I believe it is the codliver oil rather than the phosphorus that possesses medicinal virtues. Arsenic, iron, and strychnine have served me very well, especially when atony of the stomach or dyspeptic conditions existed. The careful regulation of the bowels and good action on the part of the kidneys and skin will greatly aid in modifying rickets when established.

A concentrated form of codliver oil, containing its antirachitic and antiophthalmic properties has been in use at the Infantorium since 1922. Each tablet* contains the equivalent of one-half teaspoonful of codliver oil.

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[1] Howland, John, and Park, E. A.: "Some Observations on Rickets." Tr. Am. Pediat. Soc., 1920.

[2] Phemister, Miller, and Bonar: The Effect of Phosphorus in Rickets. Jour. Am. Med. Assn., March 26, 1921.

The mercury vapor quartz lamp used daily has specific virtues in the treatment of rickets.

Treatment of Deformities.—*Kyphosis:* In rachitic kyphosis a Bradford frame or a similar appliance is indicated. A spinal brace will sometimes do good. Massage with good friction will develop a weakened spine in some cases, and plaster of Paris jackets may be serviceable. Manual correction of the deformity will aid in the treatment.

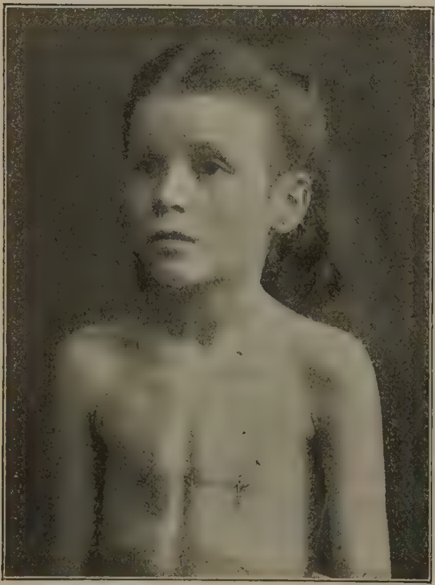

Fig. 96.—Rachitic kyphosis (spine). Permanent deformity. Rachitic thorax in school girl, 12 years old, showing Harrison's groove, and funnel-shaped depression of sternum.

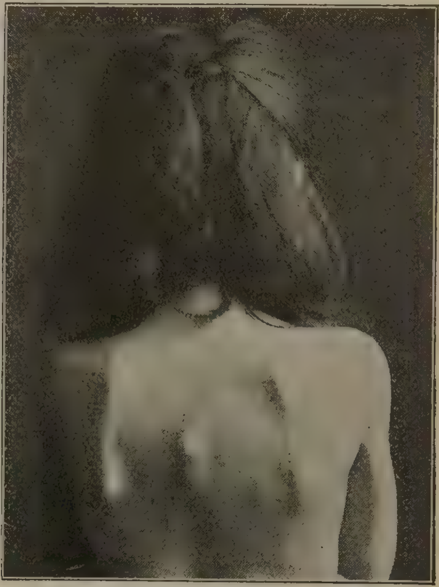

Fig. 97.—Back view same child, showing rachitic kyphosis. This deformity is the permanent result of rickets in infancy. It is to be differentiated from Pott's disease. Note also the curvature of the spine.

Scoliosis (*Lateral Curvature*) *and Lordosis* (*Forward Curvature*) *of the Spine.*—The management of these conditions is similar to that described for kyphosis.

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* Courtesy of Drs. Harry A. Dubin and Casimir Funk, H. A. Metz Laboratory.

Cubitus, Varus, and Valgus.—These deformities disappear as a rule without special treatment.

Bow-legs (*Genu Varum*).—This common rachitic distortion may be congenital or it may be an acquired condition. The treatment consists in support and correction by braces.

Whitman believes that correction by osteotomy or osteoclasis is necessary when children are over 5 years of age. For knock-knees braces are usually necessary. The Thomas knock-knee brace is the most efficient. In some cases osteotomy of the femur just above the epiphyseal line is indicated.

Antero-posterior bow-leg can only be corrected by osteotomy.

Genu Recurvatum (*Back-knee*).—Whitman states that in its most extreme form it is of congenital origin, and is usually associated with defective development of the anterior thigh muscles and the patella. In such cases the knee is bent directly backward, and the tibia is often displaced forward upon the femur. In the milder types of back-knee there is simply an abnormal or over-extension caused by laxity of the ligaments and supporting muscles. This form is usually secondary. It is often seen in cases of hip disease after prolonged mechanical treatment. It may be associated with congenital talipes, or it may be the direct result of paralysis of the muscles of the legs, or even of general weakness, as in severe rachitis.

The following are the principal points in the differential diagnosis of rickets and Pott's disease:—

TABLE NO. 36.

RICKETS.	POTT'S DISEASE.
Deformity not angular.	Angular.
Result of posture.	Result of lesion.
Evidence of rickets elsewhere.	Absent.
In infancy.	Usually later.
In middle and lower part of the spine.	In any part.
The body may be bent forward without discomfort.	Forward flexion causes pain.
The curve is lessened, or it may be obliterated when the trunk is extended.	Never disappears.

Surgical Treatment.—It is always advisable to consult a surgeon or orthopedist concerning deformities in early life. Very many rachitic deformities due to softened diapheses can be corrected or modified as described in the treatment previously given.

When a brace appears unsatisfactory, then surgery may yield excellent results, but surgery must be used in conjunction with proper nutrition and restorative treatment to secure permanent benefit.

CELIAC DISEASE.

(Chronic Intestinal Indigestion.)

This is a disease of unknown etiology which occurs not infrequently in younger infants and in older children, either in breast-fed or in artificially-fed children. The symptoms are those of failure to gain, an actual loss of weight, pallor, and frequent crying. The children have a characteristic appearance. They are very bright looking and have a very large abdomen somewhat suggesting a megacolon. The tongue is smooth and the turgor of the skin is poor and thin. Diarrhea alternates with constipation and the stools are frequently very large in amount as well as frequent in number. They have a whitish appearance and contain large amounts of fat suggesting a disturbance in the pancreatic ferments.

Symptoms are often continued for weeks at a time before a definite diagnòsis can be made as the onset is often insidious and relapses are frequent.

Treatment.—This is often difficult and varies with the individual case. In general, patients do better on a diet of relatively high protein content and relatively low starch and fat content. Foods which have bulk and leave a residuum such as, cereals containing cellulose and many vegetables, are chiefly to be avoided. Diets rich in bananas as advocated by Haas are often efficacious. Protein milk with gradual additions of dextrimaltose to raise its caloric value is beneficial and in older infants, scraped beef and roast chicken are well tolerated. The general hygiene of the patient is in addition extremely important.

PART V.

Diseases of the Heart, Liver, Spleen, Pancreas, Peritoneum, and Genito-urinary Tract.

I.

INTRODUCTORY.

THE HEART AND FETAL CIRCULATION.

The circulation of the blood during the whole fetal period of antenatal life is the same.

According to Ballantyne,[1] during the neo-fetal period, it is true the circulation is that of the chorion; but by the end of it there has been a specialization of the circulatory function, and the blood, instead of being sent to the villi over a wide expanse of chorionic surface, is now directed solely to those found over one part of it, that, namely, which is in contact with the decidua serotina, the site of the developing placenta. From the end of the neo-fetal period onward to the moment of birth, there is the circulation of the placenta.

The essential peculiarity of the placental circulation is the sending of the fetal blood out of the fetal body to a specially prepared and extracorporeal organ (the placenta) for purposes of oxygenation and other less understood chemical changes. This entails simply the presence of an efferent vessel (or vessels) to carry the blood to the extracorporeal organ and of an afferent vessel to bring it back again.

Changes at Birth.—When the umbilical cord is ligated there is an interruption of the circulation through the umbilical vein and arteries, so that in about ten days after birth the circulation loses its fetal type and assumes extrauterine conditions.

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[1] For those interested I would advise reading Ballantyne's book on antenatal pathology and hygiene.

The following physiological changes occur:—

(*a*) The conversion of the ductus arteriosus.

(*b*) The ductus venosus into fibrous cords.

(*c*) The closure of the foramen ovale.

(*d*) Changes in the umbilical veins and umbilical arteries, the first forming the round ligament of the liver, the second the true anterior ligament of the bladder and the superior vesical arteries.

For some weeks before birth the circulation through the foramen ovale is slight, it being gradually obstructed by the growth of a septum which nearly fills the space at birth. After the first week of extrauterine life, very little if any blood passes through it, although complete closure of the foramen often does not take place until the middle of the first year. In one-fourth of the autopsies Holt made upon infants under six months of age, minute openings at the margin of the foramen ovale were found. They were usually oblique, and closed by the valvular curtain so as to effectually obstruct the current of blood. The ductus arteriosus is first closed by a clot, which becomes organized and blends with the products of a proliferating arteritis. It is rarely found open after the tenth day, and by the twentieth it is almost invariably obliterated.

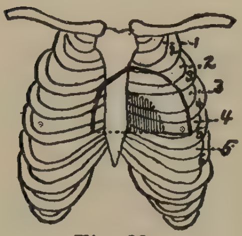

Fig. 98.

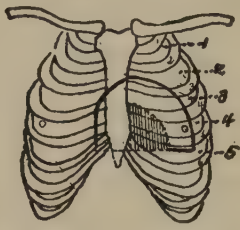

Fig. 99.

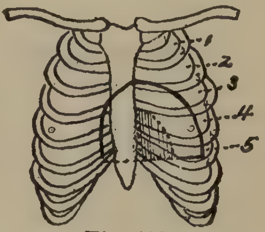

Fig. 100.

Fig. 98.—Note the position of the apex beat in a very young infant; during the first year it is very high, between the fourth and fifth intercostal spaces. It is most often in the fourth.

Fig. 99.—The apex beat in a child about 6 years old. It is lower than in an infant. Usually found at the fifth intercostal space.

Fig. 100.—The apex beat in a child about 12 years of age is found between the fifth and sixth intercostal space.

The heavy black lines denote the area of relative dullness. The small shaded areas denote the area of absolute dullness. (After *Unger.*)

THE HEART.[1]

Size of the Heart.—The relative size of the heart is greater in children than in later life. It is the smallest about the seventh year.

TABLE NO. 37.—WEIGHT OF THE HEART (BOYD).

Age	Grams.
At birth	20.6
One and one-half years	44.5
Three years	60.2
Five and one-half years	72.8
Ten and one-half years	122.6
Seventeen years	233.7

The anatomical differences in the child are:—

(*a*) A more horizontal position of the heart than in the adult.

(*b*) The diaphragm being higher, the heart is higher in the thorax.

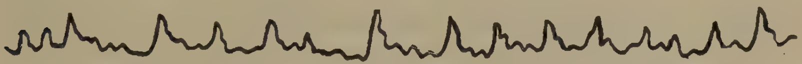

Fig. 101.—Irregular pulse, low tension, from a case of mitral regurgitation.

(*c*) The ribs in a child are more horizontal than in the adult.

(*d*) The liver in young children is larger than in adults, and as the heart is in close contact with the liver the area of cardiac dullness merges into that of the liver dullness below.

Tension.—The degree of contraction of the vascular muscles determines the size of the artery and (to a great extent) the tension of the blood within it. But if the heart is acting feebly there may be so little blood in the arteries that even when tightly contracted they do not subject the blood within them to any considerable degree of tension. To *produce high tension,* then, we need two factors: A *certain degree of power in the heart-muscles,* and contracted arteries. *To produce low tension* we need only *relaxation of the arteries,* and the heart *may be either strong or weak.*

The pulse of low tension collapses between beats so that the artery is less palpable than usual or cannot be felt at all. Normally, the artery can just be made out between beats, and any considerable lowering of arterial tension makes it altogether impalpable except during the period of the primary wave and of the dicrotic wave, which is often very well marked in pulses of low tension.

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[1] Heart murmurs are described on page 379.

The pulse of high tension is perceptible between beats as a *distinct cord which can be rolled between the fingers,* like one of the tendons of the wrist. It is also difficult to compress in most cases, but this may depend rather on the heart's power than on the degree of vascular tension. The pulse wave is usually of moderate height or low, and falls away slowly with little or no dicrotic wave.

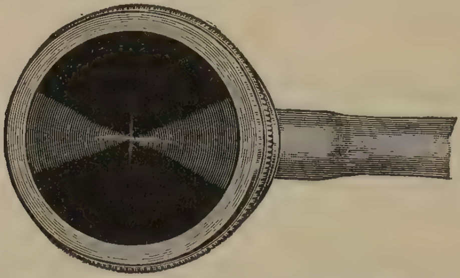

Fig. 102.—Natural size of Bowles stethoscope for examining children.

Mode of Examination of the Heart.—The ear should be used, rather than an instrument in listening to the heart sounds in struggling children. In children with eruptive fevers it is safer to use a stethoscope, or the Bowles phonendoscope. It has a flat attachment which can conveniently be placed in the axilla or to the posterior portion of the lung without raising the child from the bed. These advantages are important inasmuch as we frequently can examine the child while asleep.

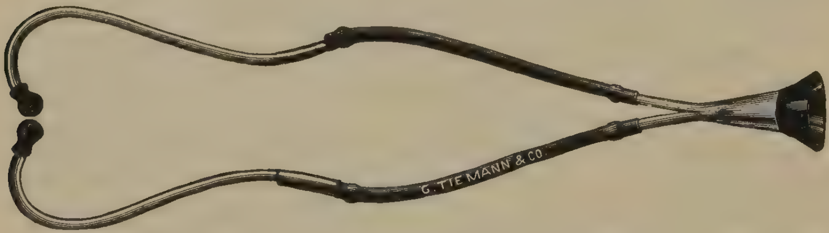

Fig. 103.—A convenient stethoscope for children.
Made by G. Tiemann & Co.

The following aphorisms are drawn from Crandall:—

1. The apex lies higher in the chest and further to the left than in the adult.

2. The apex beat is hard to detect in the infant. In the child palpation shows this easier than in the adult.

3. The area of dullness is comparatively large. (There are three stages in infancy and childhood during which differences are noted in relative and absolute dullness.) (See Figs. 98, 99, and 100.)

4. Murmurs are heard over comparatively large areas. A study of differences in the quality of the sounds and points of greatest intensity will help us here.

5. The rate may be increased and the rhythm altered by slight causes.

6. In rachitic children and in those affected by empyema or pleural effusions and adhesions the apex may appear in an abnormal position.

7. Prominence of the precordia is sometimes marked. Normally the loudest sound is the first sound at the apex; the weakest sound is the second sound at the aortic area. It does not seem to be generally recognized that the pulmonic second sound is in early life stronger than the aortic sound.

TABLE No. 38.—CLASSIFICATION OF CARDIAC DISEASES.

Time of Occurrence.	Nature of the Affection.		Clinical Disease.	
Intra-uterine existence or very early infancy.	Developmental or Inflammatory.		Various congenital affections.	
Extra-uterine existence (infancy or childhood).	Various motor or sensory phenomena unaccompanied by sensible changes of structure.		Functional diseases of the heart.	
	Organic,	Mechanical.	Dilatation, Hypertrophy,	Alone or as accompaniment of inflammatory change.
		Inflammatory.	Pericarditis, acute or chronic. Endocarditis, acute or chronic. Myocarditis, acute or chronic.	
	Miscellaneous.		Effusions (non-inflammatory). Granulomata. Neoplasms.	

II.

DISEASES OF THE HEART.

REFLEX SYMPTOMS OF THE HEART.

Tachycardia.—Severe palpitation of the heart (tachycardia) frequently results from excitement or fright in children. This is a normal nervous response of the heart in contradistinction to the tachycardia occurring in hyperthyroidism. The heart on auscultation will be found normal, and the only symptom noticeable will be an exaggerated pulse-rate with an increase of twenty to forty beats per minute. It is usually a neurotic manifestation. The prognosis is good.

Bradycardia.—A slowness of the heart's action and a slow pulse-rate are occasionally met with in children. It may occur in health, although very rarely without pathological significance. I have usually seen bradycardia in septic cases of diphtheria at my service in the Willard Parker Hospital, and in the toxic type of scarlet fever at the Riverside Hospital. When bradycardia is seen during the course of acute infectious diseases it should be regarded as a very serious symptom (see chapter on Diphtheria).

POINTS TO BE NOTED IN THE DIAGNOSIS OF DISEASES OF THE HEART.

HEART SOUNDS AND MURMURS.

First Sound.—*In infectious fevers* there is an increase in the length and intensity of the first sound heard at the apex.

In continued fevers causing degeneration of the heart muscles there is a shortening and weakening of the first sound heard at the apex.

In exhaustive heart strain seen in myocarditis the first sound is feeble and merges into the second sound. This condition is met with in diphtheria, scarlet fever, and typhoid, although any disorder of the body which devitalizes may cause it.

Fatty heart, emphysema, or *pericardial effusion* may give a feeble mitral first sound.

Pulsus Paradoxus.—The heart-beats during inspiration are more frequent, but less full, than during expiration. This condition may be observed in healthy children during sleep.

An irregular heart action may occur during sleep in healthy children. The heart action is frequently influenced by inspiration and expiration.

Systolic Murmurs.—There are two murmurs possible for each orifice, or eight in all. Of these, four, namely, mitral systolic, mitral presystolic, aortic systolic, and aortic diastolic, are most likely to occur, with a frequency about in the order of their enumeration. The necessary changes being made, a like distribution applies to the right side; although a pulmonary lesion is almost unknown, except as a congenital affection, while disease of the tricuspid valve is less rare.

Every murmur is determined by the time of its occurrence, the direction which it takes, and the location of its greatest intensity. The blood is driven from the left ventricle, during systole, through the aortic orifice, and, meanwhile, all communication with the auricle of this side is cut off by a closure of the mitral valve. But should the current encounter an obstacle at the aortic opening in its onward course, it would be thrown into confusion in the aorta, from which a murmur would arise and be carried upward. Hence this bruit is loudest at the aortic area, systolic in rhythm, and extends in the direction of the carotids.

Should the mitral valve fail to close at this time the blood would escape into the left auricle, as well as run through the proper channel, and be set in vibration by the impeding flaps at the mitral orifice. Here the bruit generated by this disturbance is borne with the reflux into the auricle, and thence to the back, and also by conduction through the apex to the front. Moreover, it is *loudest in front and at the apex,* because the heart is nearer the anterior than the posterior surface of the chest. Therefore, this murmur is *most intense at the mitral area, systolic in rhythm, commonly diffused to the left, and often audible near the inferior angle of the left scapula.*

In a similar manner during systole, the blood is being propelled by the right ventricle through the pulmonary aperture, and likewise the tricuspid valve is closed or very nearly so. Thus supposing that an *obstruction were to occur at the pulmonary orifice,* there would be a *systolic murmur, with point of maximum* *intensity in the pulmonary area and extension upward to the left, but not into the carotids.*

In the event of *tricuspid insufficiency,* part of the blood would flow back into the right auricle, and give rise to a *systolic bruit, best heard in the tricuspid area,* and *spreading upward to the right.*

Anemic Murmurs.—An anemic murmur is always systolic in rhythm, loudest at the base of the heart, and often as audible in the aortic as the pulmonary area. With anemia pure and simple there should be no cardiac hypertrophy.

Diastolic Murmurs.—In diastole the aortic and pulmonary valves are closed, and the auriculo-ventricular valves open, while blood is flowing from the auricles to the ventricles. The vermicular contraction, styled cardiac systole, which was initiated in the veins and taken up by the auricles, has gone through the ventricles and reached the large arteries, wherein the recoil of the current finds a point of support at the closed semilunar cusps.

If the function of one or more of these cusps in the aortic valve be destroyed, each contraction of the artery will drive a portion of its contents back into the left ventricle; and the vibrations generated in this return stream against the disorganized valve will cause a bruit that is *aortic* in origin and *diastolic* in rhythm.

Though this murmur of insufficiency is conveyed along the arteries a varying distance in the efflux, its main direction is backward with the reflux; not so much in the line of the ventricle as down the sternum, owing to the close proximity of this bone to the aortic valves, and its superiority over the heart as a conducting medium of sound. *The point of maximum intensity of this bruit is more often at the lower end of the sternum than in the second intercostal space.* Granting that the same thing could happen to the pulmonary valves, a *diastolic murmur would be audible in the pulmonary area, but with an extension downward only.*

An *aortic systolic murmur is loudest in the second right intercostal space close to the sternum,* and a *diastolic bruit is heard loudest at the lower extremity of this bone.* In some instances these murmurs are heard only at mid-sternum, about on a level with the third costal cartilages. In others they are most intense in the second, and even the third intercostal space, close to the left edge of the sternum. Upon the exclusion of aneurism, a bruit within these precincts is presumably aortic and not pulmonary, especially if the right ventricle is unenlarged.

Pericardial Murmurs.—A pericardial is distinguished from a pleuritic friction mainly by the time and locality of its occurrence. *Grating in the pericardium obviously is limited to the precordial region, and is regulated by the action of the heart.* That of the *pleura* is most prone to take place *in the infra-axillary regions,* where pulmonary mobility is extensive. *It is dependent upon the respiratory movements.*

Venous Murmurs.—In quality venous murmurs are blowing, cooing, and sometimes musical; and from the frequent resemblance of the noise to that of a humming-top, it has been denominated *venous hum.*

It is usually most *distinct at the lower third of the external jugular veins, and more distinct in the right than in the left side.* It is always continuous in rhythm, but the intensity is often remittent because of the periodical acceleration of the stream by the action of the heart. The direction is downward and inward along the subclavian and right innominate veins, so that it is now and then audible through the aortic area, and can be separated with a little care from the aortic sounds as well as from the respiratory murmur. *When there is a question as to whether or not a given bruit is venous or arterial, pressure upon the vein above the stethoscope will stop the downward current and silence the venous hum.*

Cerebral Blowing.—A blowing, systolic murmur, of variable intensity, is frequently heard over the anterior fontanel and sometimes over the carotids of children, between the ages of 3 months and six years.[1]

PULMONARY STENOSIS (CONGENITAL HEART LESION: BLUE BABY).

A. N. H., was first seen by me when 7 months old.

Family History.—It was the third child born with natural labor. The mother has had one still-birth and one miscarriage. Has one child 5 years old in good health with no evidence of heart trouble. Both father and mother are in excellent health, and there is no evidence of heart or lung trouble, and no specific disease on either side. This child has been cyanotic. The toe nails and finger nails show typical clubbing and also blueness. On the slightest exertion the infant's skin assumes a very dark blue color. Dyspnea is also present. The cutaneous circulation is very poor and the nurse informed me that for one-half hour after a tub bath there is an increased evidence of cyanosis.

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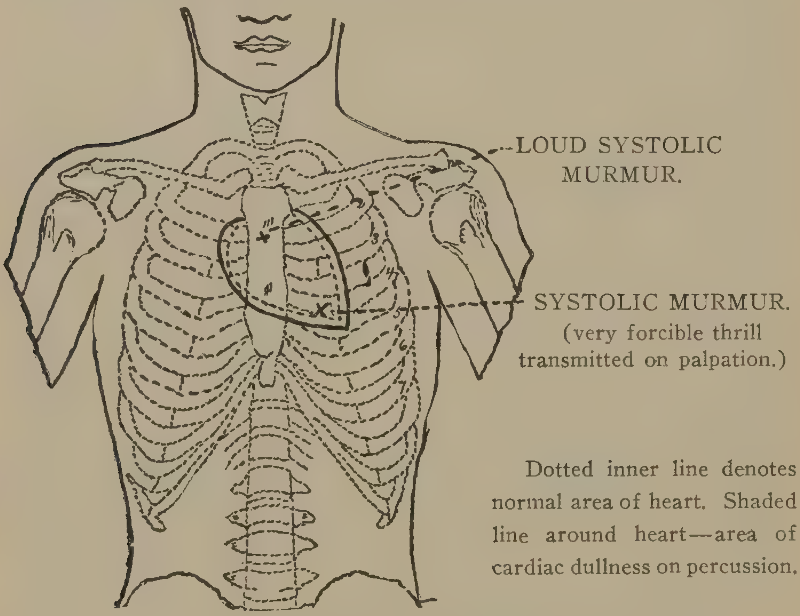
[1] I am indebted to S. S. Burt and E. Le Fevre for some points in the above article.

A loud blowing systolic murmur could be made out in the second right intercostal space. There was also a weakness of the pulmonary second sound. The area of dullness was increased so that a right-sided hypertrophy undoubtedly existed. The murmur was not transmitted to the vessels of the neck.

The infant was breast-fed by its mother for four and one-half months. There has been a tendency to constipation. The stool has been green and contained white curds at times. During the last few months the feeding consisted of equal parts of barley water and milk. When seen again the appetite was poor. The tongue slightly coated. The general condition one of restlessness by day and insomnia by night. The infant was very sensitive to cold and had a diffuse bronchitis associated with acute rhinitis. I ordered:—


LOUD SYSTOLIC MURMUR.
SYSTOLIC MURMUR. (very forcible thrill transmitted on palpation.)
X

Dotted inner line denotes normal area of heart. Shaded line around heart—area of cardiac dullness on percussion.

Fig. 104.—Case of pulmonary stenosis—congenital—blue baby.

℞ Raw milk	12 ounces.
Rice water	24 ounces.
Granulated sugar	6 drams.
Lime water	6 drams.
Peptogenic milk powder	2 measures.

Divide in 6 bottles. Feed every three and one-half hours.

As the food agreed very well, I ordered 1 ounce more of milk to the total quantity every second day until the infant received full milk undiluted.

I ordered to relieve the dyspnea and regulate the heart:—

℞ Sodium iodide	15 grains.
Sparteine sulphate	3 grains.
Elix. lactopeptin	2 ounces.

Half-teaspoonful three times a day.

The progress of the case was excellent. When first seen by me there was no evidence of dentition. At the ninth month the child had two teeth and showed signs of general development.

Prognosis.—As a rule the outcome of these cases is bad, although I have known a child with a pulmonary stenosis for the last twelve years. He is now 18 years old. These cases have a tendency to pulmonary disease, and are especially prone to develop tuberculosis.

Treatment.—There is no treatment of any value to cure this condition.

PERSISTENCE OF THE DUCTUS ARTERIOSUS BOTALLI.

During the first four weeks after the birth of an infant, the ductus arteriosus is closed by an overgrowth of the cells in its inner wall. When abnormal conditions exist, such as septic infection of the new-born with thrombi, a breaking down of the cell growth takes place and results in the duct remaining patent. This may also result from defective respiration and an anomalous pulmonary circulation.

The clinical symptoms of the patency of the ductus arteriosus are rapid hypertrophy and dilatation of the right ventricle, with co-existing dilatation of the pulmonary artery. There is also an increased area of cardiac dullness. Loud systolic murmurs are heard all over the chest, and a thrill of the anterior chest wall can be felt. Protrusion of the upper part of the sternum—dyspnea rarely—cyanosis and a deathly pallor are other symptoms.

Gerhardt states that dullness is found at the border of the second rib, in which region the systolic pulsation of the pulmonary artery can be felt.

M. G., 4 months old. Was two weeks prematurely born. She was the second child. The first child died of diphtheria; it was also prematurely born, and died when its mother was four months pregnant with the present baby. The mother had a normal pregnancy, but was greatly troubled with headaches and dizziness, and suffered mentally over the loss of the first child.

The Baby.—When the baby was 6 weeks old the mother first noticed that it breathed with difficulty. It had been vomiting continuously. Diarrhea has existed for ten weeks. There is an occasional cough. Since two weeks the baby appears colicky and cries with apparent pain.

Stat. Præs.—A pale, very anemic looking child, with large fontanel, somewhat depressed, the size of a silver quarter.

The Eyes.—There was a slight exophthalmus. The nose, somewhat depressed. Slight coryza.

The Heart.—The area of dullness extends from the right side to the left border of the sternum, corresponding to the lower border of the third rib. The apex is at the lower border of the fifth rib, immediately under the mammilla. The heart is somewhat enlarged toward the left side.

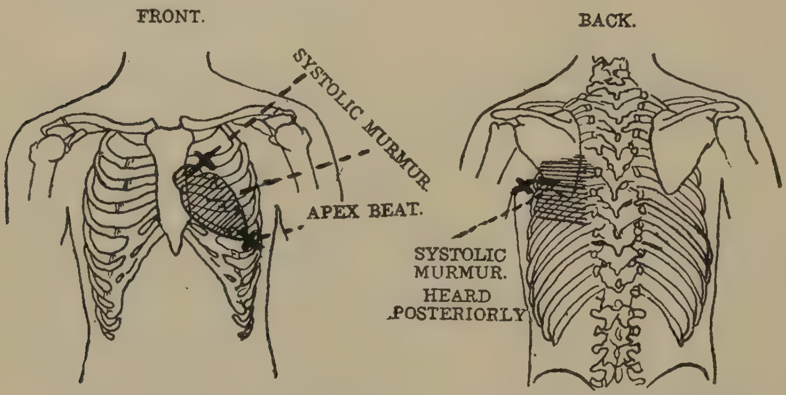


Fig. 105.—Child with persistence of the ductus arteriosus botalli. **X**, Loud murmur audible—blowing presystolic.

Auscultation.—A loud presystolic murmur is heard over the whole area of the heart. There is marked abdominal respiration. The lungs are normal on percussion. Moist râles can be heard over both lungs.

The Abdomen.—The abdomen is distended and is tympanitic on percussion. It feels doughy on palpation. There is no cyanosis of the fingers or toes. There is a mild dyspnea. The adipose tissue is not very apparent. There is marked prominence of the subcutaneous veins of the scalp.

The clinical history of the mother did not give any evidence of miscarriage, no syphilis, and no family tuberculosis.

ENDOCARDITIS.

This disease is of frequent occurrence during infancy and childhood. Congenital endocarditis has frequently been reported, so that it is assumed it must have existed during fetal life.

Etiology.—Gerhardt and Bednar believe that the disease occurs quite frequently in young children, although the greatest frequency is noted between the sixth and the twelfth years. Acute rheumatism is very frequently followed by endocarditis. Chorea is also frequently accompanied by endocardial disease. Scarlet fever, measles, variola, varicella, diphtheria, typhoid, and tuberculosis, according to Reimer, are frequently followed by or associated with endocarditis. When endocarditis follows pneumonia, pleurisy, or bronchitis, it is due to the invasion of pathogenic bacteria. These are the staphylococcus, according to Frankel and Sanger, and the pneumococcus, according to Netter and Weichselbaum. Streptococci are often a cause of endocarditis, and can frequently be cultured from the blood. It is quite likely that endocarditis is caused by such invasion in acute joint inflammations, in phlegmonous periostitis, lymphangitis, pericarditis, myocarditis, and puerperal infections. Bouchut has reported cases of endocarditis following erythema nodosum and hereditary syphilis. Von Dusch has reported endocarditis following extensive burns of the hand.

Pathology.—The lesions occur most frequently on the valves of the heart. The valves on the left side of the heart are most frequently affected; the mitral is the seat of the lesions more often than the aortic valve.

The pathological changes consist in hyperemia, swelling, and an infiltration of normal cells or new connective-tissue cells having a grayish white color. There is a breaking down of the epithelium, besides which wart-like excrescences called vegetations are formed on the free border of the thickened valves (endocarditis verrucosa). The result caused by the last-named condition is that the vegetations prevent a proper closing of the valves, which latter results in insufficiency and stenosis. Fibrinous deposits are frequently noted on the valves, and on being carried with the circulation may lodge in the cerebral arteries, causing either emboli or infarctions, according to Virchow. The last-named condition is exceptional in acute endocarditis.

Symptoms.—Endocarditis, whether primary or secondary, begins with fever. Not infrequently the temperature rises to 102°, sometimes 103° F., and there is a corresponding increase in the pulse-rate. The pulse is rapid, irregular, and of low tension. Cyanosis is sometimes preent, especially so if myocarditis accompanies the attack. Sometimes a child will develop endocarditis without any special symptoms being present. Not until the heart is examined will the condition be diagnosed. Thus an important rule which has been previously mentioned is the necessity of always listening to the heart when a diagnosis is uncertain. Frequently a few days will pass without specific symptoms being recognized. A child will show evidence of malaise and suddenly the characteristic blowing systolic murmur will be heard at the apex. The murmur is usually transmitted to the left and can also be heard behind. It is frequently accompanied by the thrill and by an accentuated pulmonic second sound. When dilatation results there will be a cardiac insufficiency. The murmur may gradually increase in intensity and in the same manner it may diminish until it is inaudible. When fever suddenly appears during the course of chorea, endocarditis should be suspected. In some cases dyspnea may be present.

The diagnosis is frequently obscure because a child will have no symptoms of a definite nature. If, however, we are patient and carefully examine the heart, we may be rewarded by making the diagnosis. It is important to examine all the organs of the body before making a positive diagnosis, if obscure or no cardiac symptoms exist.

A cardiac murmur heard during an acute attack of rheumatism, or during the course of an acute infectious disease, is usually indicative of endocarditis, especially if on pressure with the stethoscope the murmur remains permanently. Associated with the murmur there is usually a rise in temperature.

Inspection will always show a rapid and diffuse apex-beat.

Palpation will confirm this observation and may reveal a strong but irregular heart action.

Percussion is usually negative.

Physical signs are due to (*a*) insufficiency, (*b*) roughening, (*c*) stenosis, depending on changes in the valves. The character of the murmur depends on the valve involved and the lesion of the valve. In *mitral regurgitation we have a systolic murmur with greatest intensity over the apex.* It is *usually transmitted to the side, and also heard behind the sternum.*

Differential Diagnosis.—In *mitral stenosis we have a presystolic murmur with the greatest intensity over the mitral area.*

In *aortic regurgitation we have a diastolic murmur with the greatest intensity over the aortic valve, and transmitted down the sternum.*

In *aortic roughening we have a systolic murmur with the greatest intensity over the aortic valve.* Distinct murmurs can be heard at the valves of the right side.

An embolism in some portion of the body is frequently the sign of a heart lesion. If the embolus reaches the brain, hemiplegia is the usual result. If it reaches the lungs severe dyspnea may result. An embolus in the mesentery may result in diarrhea. If in the kidneys, hematuria may result. When it reaches the limbs it means an obstructed circulation.

Prognosis and Course.—Endocarditis if carefully managed with rest and strengthening diet will improve. I have seen children with endocardial murmurs improve after a few weeks, when put to bed amid quiet surroundings. As a rule the prognosis is bad and the course of the disease tends to become chronic. In giving an opinion as to the outcome of a case of valvular lesion, we must remember that we are dealing with a damaged heart, and that months or years may pass before recovery can take place. A fatal outcome will be the result of carelessness or mismanagement.

Treatment.—Nothing will do more good than absolute rest in bed. Small doses of codein or Dover's powder act very well. If endocarditis accompanies or follows rheumatism, then the salicylates should be given. An ice-bag over the heart is frequently useful. If the pulse is very rapid or the heart's action is feeble, then digitalis or strophanthus should be given.

The tincture or an infusion of digitalis made from English leaves is the best. A point to remember is that digitalis has frequently an accumulative effect so that the pulse must be carefully guarded during its administration. When this is the case the administration of the tincture of strophanthus will be found very serviceable. In some children digitalis will be badly borne owing to its irritant action on the gastric mucous membrane. In such cases strophanthus should be prescribed and given intramuscularly.

Adrenalin chloride solution taken internally increases the blood pressure, stimulates the heart, and retards the pulse-rate. It is better than digitalis, as it does not irritate the gastric mucous membrane, and it is non-cumulative.

℞ Sol. adrenalin chloride .... 1-1000.
Infants of 1 year, 1-5000, made with normal saline solution.

Dose: Five to 10 drops, three times a day, gradually increased until effect on pulse is manifested.

In some cases marked benefit will follow the use of iodide of sodium in doses of 1 to 5 grains, according to age. The iodides seem to steady the heart's action. I have found excellent results following their use.

MALIGNANT ENDOCARDITIS.

This is commonly called ulcerative endocarditis. It is a rare condition in childhood. Harris reports a case in a child 4 years old. The type of the disease is similar to that noted in adults. This condition is rarely primary. It occurs with scarlet fever, erysipelas, pneumonia, rheumatism, and septicemia, in which bacterial invasions of streptococci or pneumococci occur. These germs are found in the endocardium.

Pathology.—Vegetations usually occur with ulcerations in the cavities and on the valves. Suppuration of the deeper tissues with abscess formation is frequently noted. Osler states that the different parts of the heart are affected in the following manner: Mitral valve, aortic, mitral and aortic combined, tricuspid and pulmonic valves, and the cardiac wall. The secondary lesions of malignant endocarditis are due to emboli. These are most frequent in the spleen and kidney, next in the brain, intestines, and skin, and, if the right side of the heart is diseased, in the lungs. These emboli lead to the formation of red or white infarctions, to hemorrhages, or to multiple abscesses in the various organs and tissues in which they lodge.

Symptoms.—It is extremely difficult to diagnose malignant endocarditis. The presence of symptoms of pyemia or septicemia, associated with a heart murmur, usually renders the diagnosis positive. There is a remittent type of fever, occasionally delirium and extreme prostration. The cerebral symptoms frequently suggest meningitis. There is sometimes a faint mitral regurgitant murmur. Not infrequently it is entirely absent. The spleen is usually enlarged. Hemiplegia as well as hematuria and rapid swelling of the spleen, or possibly symptoms of pneumonia, are frequently the result of emboli.

Diagnosis.—This is at times extremely difficult. The diagnosis is best made by taking a blood culture. A streptococcus when present confirms the diagnosis.

Prognosis and Course.—The rapidity of the onset and the malignancy of the disease go hand in hand. The outcome is usually fatal.

Treatment.—In addition to rest and a supporting, stimulating diet, nothing but relief of individual symptoms by routine treatment can be given.

PERICARDITIS.[1]

This disease may exist with or without myocarditis or endocardial involvement. Large effusions occur more readily in children than in adults.

Etiology and Causes.—Rheumatism is the most frequent cause of pericarditis. Apparent mild forms of rheumatism, such as are frequently called "growing pains" by the laity, are quite often complicated by pericarditis. In this manner the existence of the rheumatism preceding the pericarditis is strikingly brought out.

Pericarditis is rarely a primary condition. Septic infection of the umbilicus occasionally causes this condition.

Tuberculosis, scarlet fever, diphtheria, measles, typhoid, and influenza frequently precede a pericarditis.

Baginsky found purulent pericarditis associated with phlegmonous erysipelas, grave forms of angina, caries of the ribs, fibrinous pneumonia, bronchopneumonia, gastroenteritis, furunculosis, phlegmon of the throat, and empyema. It not infrequently follows kidney disease and scurvy.

Pericarditis is met with at any age. It has been met with in the fetus, according to Billard, Bednar, Hüter, and Steffen.

Bacteriology.—We most frequently meet with staphylococcus aureus, streptococci, bacterium coli, or the diplococcus pneumoniæ.

Pathology.—Pericarditis may be divided into:—

(*a*) Plastic pericarditis.

(*b*) Pericarditis with serous or purulent effusion.

(*c*) Adherent pericarditis.

Any of the above-mentioned varieties consists of an inflammatory affection involving the serous covering of the heart and its reflection on the inner surface of the pericardial sac.

Symptoms and Diagnosis.—The *acute condition* begins with fever reaching as high as 104° F. in some instances. Associated with this there is pain in the precordial region. Dyspnea is present. There may be left pleurothotonos (a bending of the body to one side). The pulse is usually rapid. When there is effusion the child will complain of either very sharp pains or merely a sense of heaviness and discomfort. Syncope, singultus, and severe manifestations are present in the severer types of the disease. Not infrequently there may be delirium, twitching, and cerebral symptoms simulating meningitis. When effusions are abundant, cyanosis may occur.

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[1] The anatomical outlines are illustrated and described in the article on The Heart and Circulation. See Introductory, Part V.

The physical signs resemble those of adults. In dry pericarditis a double friction sound is heard over the precordial space. The friction sounds may vary in intensity. It may be a grating sound or it may be a weaker rubbing sound. The friction sound or murmur is usually loudest at the base of the heart. Its intensity depends on the change of position so that it is louder when the child sits up or when it exerts itself as in walking or bending. When the child is quiet or lies on its back the friction sound is weaker.

When a large area of the heart is involved, the friction murmur will also be heard with great intensity at the apex. When a child is placed in the knee-elbow position, the apex beat which could not be palpated may reappear. This is an important symptom of exudative pericarditis.

The pericardial friction sound may be purely systolic at the beginning of the disease; thus we must differentiate it from an endocardial murmur. Its maximum intensity is at the base and it is not transmitted beyond the precordial region, whereas in acute mitral endocarditis we have the maximum intensity of the systolic murmur at the apex. It is transmitted to the side, and heard also posteriorly at the angle of the scapula. Friction sounds disappear as serum is poured out and reappear as it is absorbed. The sound is not transmitted and is independent of the respiratory movement. If effusion takes place the apex-beat will be found displaced, sometimes upward and outward or indistinct; in some instances it cannot be found at all. There may be bulging of the chest wall. The intercostal spaces become very prominent. On palpation there is an absence of vocal fremitus over an area usually occupied by the lung.

Percussion gives an area of marked dullness or flatness of triangular shape, the base being below and the apex above. The normal area of cardiac dullness is increased in all directions, and this dullness extends beyond the limits of the heart. On auscultation the heart sounds are feeble and distant. Endocardial murmurs may also be present. In infants physical signs are often entirely wanting, or the normal sounds may be feeble, distant, or absent.

The usual duration of acute pericarditis is from one to three weeks. The ordinary dry form, with the resulting adhesions, may be followed by a *subacute or chronic form* of the disease. In the serofibrinous form the serum is usually absorbed quite promptly, and only adhesions are left or a chronic inflammation follows, with exacerbations in each recurrence of rheumatism. In the purulent form of the disease in young children, death is the most frequent termination. If the pus is evacuated or spontaneous opening takes place, there may be recovery, but always with more or less extensive adhesions remaining.

Prognosis.—The prognosis should always be looked upon as very grave. Steffen states that out of 35 cases only 6 recovered. When this disease follows pyemia, or when it is a sequela to the acute infectious disease, the prognosis is very bad. When it is associated with rheumatism the ultimate results, by reason of adhesions and dilatation, are usually very serious.

Treatment.—Children affected with acute pericarditis should be put to bed and kept quiet. An ice-bag placed over the heart and small doses of opium or Dover's powder seem to steady the heart's action. The value of aconite in this disease must not be forgotten, especially when we have excessive heart action. Very bad effects have been noted by me when either pilocarpine or jaborandi was given. The specific effect of salicylate of soda, salol, or salophen must be remembered if due to rheumatism. Phenacetin in 2- to 3- grain doses may be given every three hours if the child complains of pain and if fever is present. Good results may frequently be had from salophen in 2- to 3- grain doses.

Aspiration of the Pericardium.—When symptoms of collapse, cyanosis, irregular pulse, and severe dyspnea are present, then aspiration may do good. If, on aspiration, we find pus present, an incision should be made and drainage should be used as we would in a case of empyema. The proper place to puncture the pericardium is a point a little to the left of the border of the sternum in the fifth intercostal space, the needle being directed upward and outward. It must be remembered that by this means only can relief be expected. Keating states that "of 18 cases punctured only 4 recovered."

CHRONIC PERICARDITIS WITH ADHESIONS.

When children suffer with repeated attacks of rheumatism complicated by pericarditis, a chronic pericarditis frequently remains. Holt describes a case of a child sixteen months old in which the pericardial sac was completely obliterated. Associated with this condition we frequently have chronic myocarditis, hypertrophy, dilatation, and valvular lesions, so that no portion of the heart muscle or its lining membrane is normal.

Symptoms and Diagnosis.—According to Broadbent, there is a contraction seen behind in the infrascapular region, sometimes on the left, sometimes on the right side in the region of the eleventh or twelfth rib. Anteriorly we have the characteristic sign. It is a systolic retraction of the chest at or near the apex of the heart, sometimes at the tip of the sternum. This is due to the external pericardial adhesions, and is often better made out by palpation than by inspection. After the systole there is a rapid rebound, known as the *diastolic shock*. A collapse of the cervical veins during the diastole of the heart, known as Friedreich's sign, is also seen. Sometimes we see an inspiratory swelling (Kussmaul). In addition, the pulsus paradoxus is significant of the presence of pericardial adhesions, or rather of the dilatation that succeeds the adhesions. The pulse is small and feeble during inspiration, assuming greater strength during the period of expiration.

Percussion shows an increase in the cardiac dullness in all directions. The position of the apex and the percussion outline of the heart do not change with the posture of the patient, and the cardiac dullness is but little affected by full inspiration. A systolic murmur is often present. The diagnosis of adherent pericardium always presents difficulties, but it can be made with tolerable certainty in a considerable portion of the cases. On account of the enlargement of the heart and the frequency of murmurs, it is usually mistaken for valvular disease. The lesion is a permanent one and tends to increase. If a child suffers with valvulitis and the *symptoms do not yield to digitalis,* then *adhesive pericarditis should be suspected.*

Treatment.—There is no known method of treatment which will modify or improve this condition, excepting a supporting diet with absolute rest in bed and general restorative treatment. It is very important to watch the emunctories and stimulate them if their action is sluggish.

TUBERCULOSIS OF THE PERICARDIUM.

This condition is rarely met with as a primary process; it is chiefly met with as a secondary process. It usually partakes of a general tuberculous process in which all the organs of the body participate, among them the pericardium.

Diagnosis.—The diagnosis of this condition depends on the symptoms which usually accompany pericarditis. The tubercular nature of the disease must depend on the presence of tubercle bacilli in the exudate, although Unger denies the possibility of making such a diagnosis. Most probably a positive diagnosis will be made—as in many obscure lesions—*post mortem.*

The treatment is the same as that previously described in the article on Acute Pericarditis.

HYDROPERICARDIUM.

Occasionally we meet with cases in which the symptoms of dyspnea and cyanosis rapidly develop. Steffen maintains that such alarming symptoms frequently occur within a few hours, and that the same will sometimes disappear under appropriate treatment in a few days.

Pathology.—A transudation of serous liquid in the pericardium without inflammatory process is usually a secondary condition in which dropsical effusions appear. Usually hydremic conditions of the blood, such as the result of long-continued fevers in infectious diseases, tuberculosis among others, predispose to this condition.

The prognosis depends upon the cause leading to this condition.

The treatment is chiefly restorative, and will depend on maintaining the strength of the child by careful diet and hygiene.

MYOCARDITIS.

An inflammatory condition involving the heart muscles; may be either acute or chronic. It occurs as (*a*) parenchymatous, (*b*) interstitial. Steffen has reported 33 cases. It is met with more often in boys than in girls.

This affection is very frequently seen during the convalescence of diphtheria. It is also a frequent complication of scarlet fever. I have met this complication in the wards of the Willard Parker and Riverside Hospitals.

Causes.—It is rarely primary. Secondarily, it is due to congenital syphilis, or tuberculosis, endocarditis, pericarditis, rheumatic fever, toxins from infectious fevers, or phosphoric, arsenic, or lead poisoning. Traumatism has also caused myocarditis.

Pathology.—The heart muscles appear pale, soft, and friable. The whole heart is not always affected; certain portions may show evidences of degeneration and fatty infiltration, while another portion may be normal. The myocardium is very susceptible to the toxins of infectious diseases. *This is especially true when diphtheria and scarlet fever have existed prior to the heart lesions.*

Symptoms.—There are two positive signs of myocarditis, arhythmia and bradycardia. The pulse is very feeble and slow, in some cases irregular. Sometimes the pulse rate is increased. The extremities are usually cold. In some cases there is a slight rise of temperature, 100° to 101° F. Other cases show a subnormal rectal temperature of 96° to 98° F. It is very evident that the toxins of the infectious diseases inhibit the proper action of the thermic centers. I have seen distinct vasomotor disturbances, such as unilateral flushing, affecting one cheek or the lobe of one ear. The child shows a marked general depression. There is a general devitalization noticeable; also marked apathy. The child appears listless and prefers to rest.

The Heart.—There is an irregular, intermittent heart action The heart sounds are very indistinct. When the above symptoms occur during the course of infectious diseases, myocarditis should be suspected. Sometimes there is faintness, severe dyspnea, and cyanosis. Not infrequently there is albumin in the urine. Dilatation and hypertrophy sometimes occur without showing distinct symptoms. The ratio of the pulse and respiration will be disarranged.

Diagnosis.—In some cases this is very difficult to make. The presence of a slow pulse and muffled heart sounds during the beginning or during the convalescence of acute infectious diseases should always lead to the suspicion of myocarditis. A slow pulse in itself should always be looked upon as ominous.

Frequently a diagnosis of myocarditis is made at the autopsy when *no positive symptoms* of the condition *were present* during life.

Prognosis.—The prognosis is certainly not good. Rarely do we find cases of myocarditis that recover. This is especially true when myocarditis complicates the acute infectious diseases and the child is in a devitalized condition.

Treatment.—Excitement or exertion may cause sudden death. The child requires absolute rest. It should be put to bed in a recumbent position. High saline injections at a temperature of 103° to 105° F., using several quarts of salt water, can be tried two or three times a day. The diffusible effect of the hot saline, and consequently the tendency to eliminate toxins through the kidney, should serve as a valuable therapeutic adjunct. Life can certainly be prolonged by this measure; if it is cautiously done so as not to exert the child's heart, the result will be apparent very soon.

Another diffusible stimulant which has served me very well is the injection of hot water to which several grains of carbonate of ammonia have been added. In some cases of severe cardiac depression I have seen good results from the injection of:—

℞ Sp. ammon. aromatic	½ dram.
Hot water	1 quart.

Inject through a rectal tube into the colon, at a temperature of 100—105° F., once in six hours, alternating with the hot saline.

In syphilis or tuberculous conditions the treatment should be specific. When evidences of heart-failure exist, strychnine, caffein, whiskey, aromatic spirits of ammonia, and nitroglycerine may be used. Spartein in small doses (1/10 grain every hour) may be given. The value of concentrated food is greater in this condition than in any other.

Feeding.—No drug will give as much strength to the body as food. Food should be given very frequently in small quantities. A cup of concentrated chicken broth or beef broth should be given, and two hours later the white of two or three raw eggs with sweetened coffee. Milk punch, cocoa, chocolate, or strained oatmeal gruel may be given. One of the above foods may be given every two hours. Several ounces may be given at each feeding. The outcome of the case depends upon strengthening the heart. My plan has been to give the strychnine in the food. If for any reason the stomach is sensitive and does not retain food, rectal feeding with peptonized milk may be necessary along with the hot salines previously mentioned.

CARDIAC ARHYTHMIA.

When the system is overwhelmed with toxins we speak of a toxic form of disease. We have a toxic scarlet fever and a toxic diphtheria. The effect of these toxins, not only on the blood current, but also on the striated muscle of the heart, is such that marked weakness of the contractile power results therefrom. When continued the muscular contractions are enfeebled or irregular, and occasionally a beat is lost. When, therefore, this irregularity exists it is called arhythmia. The radial pulse will also show the loss of a beat and sometimes several pulse beats will be lost in one minute.

This condition usually follows the acute infectious diseases notably diphtheria and scarlet fever. It is especially noticeable in diphtheria, when the disease has had a chance to progress before antitoxin is injected. We must therefore expect this condition in neglected diphtheria.

Prognosis.—This depends on the vitality and on the amount of nutrition that can be assimilated. The most careful supervision by trained nurses is demanded, day and night.

Treatment.—Rest is imperative. The child should not be permitted to walk. The muscular strength of the heart must be restored by means of strychnine, $\frac{1}{100}$ of a grain gradually increased until $\frac{1}{60}$ or $\frac{1}{50}$ of a grain is given every three to four hours, or until the effect on the pulse is noted. This dose is for a child of from 5 to 10 years, a child of from 1 to 5 years should receive half the dose. Three to 5 minim doses of a 1 to 2000 solution of adrenaline may be given hypodermically twice a day in addition to the strychnine. Whiskey and other forms of alcoholic stimulation are recommended by many, but close observation during many years of hospital service has convinced me that we can do better without whiskey than with it. Warm saline colonic flushings, temperature 102° F., using one pint may be injected every morning and evening.

TACHYCARDIA.

In toxic diphtheria and in toxic scarlet fever we meet with a very high pulse rate and a very rapid heart beat. This is termed gallop rhythm. It is a serious symptom and usually denotes a fatal termination.

Treatment.—Five to 20 minims of a 1 to 5000 adrenaline solution should be given and may be repeated in four hours. Adrenaline will steady the heart far better than digitalis. Digitalis is my second choice and should be given in the form of the fluid extract, in 1 to 2 minim doses gradually increased until 3 minims are given and repeated every three hours until the heart action and pulse is slowed. Alcoholic stimulation in the form of whiskey is frequently ordered, but my experience with the same has not been favorable.

III.

DISEASES OF THE LIVER.

THE LIVER.

The liver in nurslings is relatively larger than in adults. To examine the liver place the child on its back with the legs slightly flexed toward the abdomen. Have the child, if possible, breathe with regularity.

Position of Liver.—Dullness can be made out from the fifth intercostal space in the mammary line to about one inch below the border of the ribs. In the axillary line it reaches to the seventh intercostal space. Posteriorly, a dullness is made out at the ninth intercostal space. It can readily be palpated.

Birch-Hirschfeld found the average weight of the liver in the new-born infant about 4½ ounces (127 grams).

Steffen, who has devoted considerable attention to the liver, states that the left lobe is relatively larger in the child than in the adult.

BILE.

The quantity of bile in the gall-bladder is very small. It is of a golden-yellow color and has a neutral reaction. Its specific gravity varies from 1014 to 1053. According to Baginsky, the bile in nurslings contains organic salts—cholesterin and lecithin—fat, and various acids in less proportion than in adults. Baginsky was able to demonstrate the presence of glycocholic acid. The presence of a much less quantity of bile-acids in the infant is a beneficial physiological condition. It is a well-known fact that these acids inhibit the digestive action of the pepsin and of the pancreatic juice. Another point is that the absence of a bile-acid prevents the assimilation of large quantities of fat, as it is impossible to split up the fat into fatty acid and glycerine. Thus, fermentative processes are much more frequent in nurslings and appear with greater intensity than in the adult, because of the biliary acids. The amylacea and all substances containing flour are—owing to the above-described condition of the pancreatic juice and the bile—not fit substances to give the infant, especially during its first three months of life, *although very small quantities* *can be digested,* and after the fourth month are not only digested, but also absorbed.

Baginsky and Sommerfeld found large quantities of mucin in the bile.

JAUNDICE (ICTERUS).[1]

There are two forms of jaundice met with in children; First, hepatogenic; second, hematogenic. The most common form seen in children is a catarrhal jaundice. This is due to an extension of the catarrhal process from the stomach to the duodenum, causing catarrh of the bile ducts. (See article on Gastroduodenitis.) In the hepatogenic form there is an obstruction to the flow of bile into the bowel. It is also called obstructive jaundice.

In the hematogenic form there is no obstruction to the flow of bile, but the jaundice is due to blood conditions. We find jaundice in sepsis, in malaria, and in typhoidal conditions. Mechanical obstructions, such as round worms entering the common duct, have been reported, but they are rarities.

ACUTE CONGESTION OF THE LIVER.

In literature very little light is shed on this condition. Some authors state that malaria and other poisons, particularly phosphorus, may cause this condition. I believe that acute congestion of the liver is frequently associated with acute gastric catarrh. It is also, no doubt, one of the factors on which intestinal indigestion hinges. The symptoms are mainly those of enlargement which can be made out by palpation and functional derangement such as will be considered in the next article.

ABSCESS OF THE LIVER.

While the condition is rare in children, Legrand found 102 cases reported:—

Dysenteric abscesses	31
Traumatic abscesses	19
Appendicitis abscesses	15
Typhoid abscesses	6
Tuberculous abscesses	10
Worms	13
Pyemia	2
Doubtful	6

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[1] Icterus neonatorum is described on page 214, Diseases of the Newly Born.

In the chapter on the Intestinal Tract I have referred to worms as a causative factor. Ascarides have been found in the bile duct and the hepatic duct associated with multiple abscesses. They have also been found in the pancreatic duct.

The symptoms of fever, pain, and swelling in the region of the liver are very marked. Aspiration will aid in making the diagnosis.

The prognosis depends on the early recognition of the abscess and its immediate relief by free incision.

Treatment.—An exploratory puncture should be made early in the disease, and, as soon as pus is located, free incision should be made.

GALL-STONES (CHOLELITHIASIS).

Authentic cases of gall-stones in childhood are rare. The symptoms of biliary colic with jaundice, pain, and fever are identical with the adult type of the disease. The diagnosis can be made by the aid of an x-ray examination. No operation should be performed until a radiogram strengthens the diagnosis.

FUNCTIONAL DISORDERS OF THE LIVER.

Functional Derangement.—This very common condition is characterized by either a total absence or a diminution in the quantity of bile secreted. This functional disorder usually causes very dry, grayish or whitish, "clay-colored" stools; also flatulence. The urine is of a very dark reddish or brownish color. Frequently the skin and conjunctival mucous membrane are pigmented. The temperature may reach 101° F.; rarely higher than 103° F. If after rest, proper diet, and hepatic stimulation the fever persists, then the possibility of abscess in the gall-bladder should be remembered.

Treatment.—The salicylates may be tried. Ox bile or salts of bile acids are the best cholagogues. Diluted hydrochloric acid or diluted nitromuriatic acid, in 1-drop doses, is a good bile stimulant. In some cases a gentle faradic current and massage may do good. A cold spray over the liver will also tone the same. Large quantities of liquids will sometimes aid in relieving functional disturbance of the liver.

DISPLACEMENT OF THE LIVER.

The liver may be displaced downward when the ribs are contracted in size. This condition is best noted in rickets. The liver may also be displaced by pleural effusions. It is found much lower in diseases wherein emaciation takes place, such as in marasmic or tubercular manifestations. In these latter conditions relaxation of the abdominal walls permits the liver to occupy a position much lower than normally.

Displacement Due to Diseases of the Adjacent Organs.—The liver is sometimes displaced by tumors arising in the right pelvic region, chiefly from swelling associated with the right kidney. In a case of mine (see chapter on Pyelitis) the kidney pushed the liver upward and to the left. The liver returned to its normal position after the diseased kidney was removed.

Several years ago, at the Kaiser and Kaiserin Friedrich Children's Hospital of Berlin, I saw a case of a child having a supposed tumor involving the liver. While all believed that the swelling was associated with the liver, after the abdomen was opened it was found that the kidney was the seat of the trouble and that the liver was unaffected.

DESCENDED LIVER.

Rowland G. Freeman, in studying a series of 496 autopsies in children, states that he has met, not very rarely, with descended liver. These enlarged livers were found in children suffering with tuberculosis and lobar pneumonia. In his cases the liver had slipped down the right side of the abdomen.

AMYLOID DEGENERATION (WAXY LIVER).

This is an extremely rare condition. Freeman mentions but two cases in his large post-mortem experience, one case associated with tuberculous disease of the vertebræ and psoas abscess, and the other case in a child suffering from progressive anemia. The liver and kidney were waxy in both cases. Amyloid degeneration also occurs in children who suffer from chronic pyogenic infections, such as chronic empyema. It develops after long continued suppuration and retention of pus due to inadequate drainage.

Experimentally, amyloid degeneration has been produced by the action of the toxins of the staphylococcus pyogenes aureus.

Symptoms.—Special symptoms which could be called those specifically due to this condition cannot be described. The symptoms of the disease associated with amyloid degeneration are present on palpation. The liver is enlarged, the surface very smooth and hard, without tenderness. The spleen is also enlarged. Dropsy is usually present. The latter symptom must not necessarily be due to the kidney, but may result from pressure of the swollen liver upon the vena cava. When this disease is associated with syphilis, then symptoms of the latter disease may also be found.

The prognosis is usually bad.

Treatment.—This depends on the symptoms, which require urgent management. Syphilis, when present, requires antisyphilitic treatment. The outcome of the case depends on restorative treatment, including nutrition.

FATTY LIVER.

Fatty degeneration of the liver is very frequently noted in children. Wollstein has found 201 cases of fatty liver in 345 consecutive autopsies. Freeman and Long studied a series of 296 autopsies at the Foundling Hospital, and found 202, or about 68 per cent., fatty livers. This disease is not as frequently found associated with wasting diseases as is claimed.

The following classification of causes or conditions with which fatty liver is associated is given by C. Oddo, in *Grancher's Maladie de l'Enfance*:—

1. Intoxications: Phosphorus, alcohol.

2. (*a*) Infections, acute: typhoid fever, measles, scarlet fever, smallpox and diphtheria, bronchopneumonia, acute general tuberculosis, and diarrhea. (*b*) Infections, chronic: chronic tuberculosis, hereditary syphilis.

3. Maladies of nutrition: chronic gastroenteritis, rachitis, cyclic vomiting.

4. Fatty liver associated with the hepatic lesions.

CIRRHOSIS OF THE LIVER (INTERSTITIAL HEPATITIS).

Two varieties of cirrhotic liver are seen in children; they are: (*a*) atrophic, (*b*) hypertrophic. This condition is caused by the same factors that produce cirrhosis in the adult. The two most important factors that produce this condition are syphilis and the excessive use of alcohol. Freeman reports two cases in neither of which alcohol was the cause of the condition, nor was any acute disease reported prior to the cirrhosis.

Symptoms.—Digestive disturbances, such as fullness in the abdomen, constipation, or diarrhea, exist. The temperature is irregular. As a rule, the liver is not enlarged.

Diagnosis.—This is sometimes extremely difficult and can only be determined positively post-mortem.

Prognosis.—The prognosis depends on the cause. If due to syphilis, the prognosis is fair; if due to alcohol, then it is grave.

Treatment.—The treatment of the case depends on the symptoms presented.

FOCAL NECROSIS.

This is usually found associated with infectious diseases. It has been observed resulting from the toxin of diphtheria and measles. Freeman found focal necrosis in 4 cases out of 14 consecutive autopsies on measles cases.

Summary.—1. Descent of the liver down the right side of the abdomen, so that the right lobe reaches below the crest of the ilium, occurs occasionally in infants, and particularly in those in whom the liver is enlarged.

2. Fatty livers occur very frequently in infants and children who die at the New York Foundling Hospital, or in about 41 per cent. of all cases.

3. The condition of nutrition of the child, as expressed by the absence of fat in general and wasting of tissue, apparently has no connection with the fatty condition of the liver, the condition of nutrition in the cases having fatty livers averaging about the same as in the whole number of cases.

4. Fatty livers occur rarely in the following chronic wasting diseases: Marasmus, malnutrition, rachitis, and syphilis, unless such condition be complicated by an acute disease.

5. With tuberculosis fatty livers occur more often than with other conditions.

6. Fatty livers occur most often with the acute infectious diseases and gastrointestinal disorders.

7. The two cases of cirrhosis of the liver examined by the writer ran a comparatively acute course. The livers on section

showed a marked hyperplasia of the so-called new-formed bile ducts.

8. Focal necrosis of the liver may be a lesion of measles (Freeman).

Read article on Congenital Obliteration of the Bile Ducts in the section on The Newly Born Baby.

SUBPHRENIC ABSCESS.

This condition is very rare in children. It consists of an accumulation of pus *above the liver, but beneath the diaphragm.* Carl Beck described this condition *in extenso.*

Meltzer reports a case occurring in a child 2 years old.

Jopson[1] has recently reported a case from the Children's Hospital, in Philadelphia.

Maydl has studied a series of 179 cases. Of these cases, which were found in all ages, 10, or 5.9 per cent. were under 15 years of age. The causes in Maydl's cases were attributed to the stomach and duodenum, intestinal, pericecal (including appendicitis), echinococcus, subcutaneous traumatism, cholangitis, perinephritis, metastatic wounds and gunshot injuries, and caries of the ribs.

Jopson, in reporting the causes of 12 of his cases, includes appendicitis, perforated gastric or duodenal ulcer, caries of the dorsal vertebræ, traumatism, and calculous cholecystitis.

In a case reported by A. Frederici[2] a girl, 8 years old, had an abscess which ruptured into the lung. The diagnosis of subphrenic abscess, secondary to liver abscess, was founded on tenderness over the liver region before the abscess ruptured, and on the absence of air in the abscess cavity.

Baginsky reported a case in a child, 2½ years old, secondary to appendicitis.

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[1] Archives of Pediatrics, February, 1904.

[2] Monatschr. f. Kinderheilk., July, 1903.

IV.

DISEASES OF THE SPLEEN AND PANCREAS.

THE SPLEEN.[1]

One of the most difficult organs of a child to examine is the spleen. It can be palpated between the ninth and eleventh ribs. It is impossible to positively outline the spleen by percussion.

There are no primary diseases of the spleen, although it is frequently the seat of tubercular disease.

ENLARGEMENT OF THE SPLEEN (SPLENITIS).

An enlarged spleen is frequently seen in various systemic conditions. It is one of the characteristic symptoms of many of the acute infectious diseases. It is a prominent symptom of malarial infection and typhoid fever, and next to the condition of the blood itself is a very valuable aid in the diagnosis. In cachectic conditions and in such constitutional disorders affecting the blood, as, for example, in rickets, a very large spleen can frequently be palpated. An enlargement of the spleen reaching into the groin was seen by me in a case of rickets. The spleen, therefore, is a very valuable aid to diagnosis in many conditions.

To examine the spleen, place the child on its back, flex the legs on the abdomen and with the fingers of the left hand palpate the abdomen at the level of the umbilicus to the left of the midline, gradually working upwards toward the costal margin until the lower edge of the spleen is felt. *Some authors maintain that when the spleen is palpable it is enlarged.* I have frequently been able to palpate the spleen in perfectly normal infants. Percussion of the spleen is unsatisfactory.

WANDERING SPLEEN (MOVABLE SPLEEN, LIEN MOBILIS).

When there is an elongation of the gastro-lienal ligament, the spleen can be readily moved.

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[1] Splenic anemia and Banti's Disease are described under Diseases of the Blood.

Causes.—Severe paroxysms of coughing, such as whooping-cough or traumatism, can cause this condition.

Symptoms.—In young children there are no special guides. Older children complain of pain on the left side and vague abdominal pains.

Diagnosis.—The diagnosis is made by palpating the wandering spleen.

Treatment.—An abdominal bandage to support the abdomen will frequently aid in replacing the spleen. Rarely will surgical treatment be demanded.

THE PANCREAS.

The pancreas is situated behind the stomach. It is about the height of the first lumbar vertebræ. The function of the pancreas is known as the *amylolytic function*, namely, starch digestion, in reality the conversion of starch into sugar.

DISEASES OF THE PANCREAS.

Syphilitic tissue changes are frequently seen in the pancreas. Malignant tumors are occasionally reported in the literature. When such lesions exist they tax the diagnostic skill of the specialist. The diagnosis is rarely made *intra vitam*.

V.

DISEASES OF THE PERITONEUM.

ACUTE PERITONITIS.

This is a very rare condition in childhood. It is most frequently seen in practise in the newly born, where inflammation is the result of a pyogenic infection through the umbilical vessels. This has been described in the section on the Newly Born Baby.

Etiology.—This inflammation is frequently the result of traumatism. It may follow the operation for appendicitis or other operations on the abdomen. Cases have been reported where an infection such as gonorrhea or vulvovaginitis has extended into the uterus or into the peritoneum. This condition may frequently accompany Pott's disease or perinephritis, and may also follow deep-seated burns in which cellulitis exists.

I have seen peritonitis as a complication of scarlet fever in hospital and private practice.

Bacteriology.—The streptococcus is most frequently found to be the cause of peritonitis in the newly born. Sometimes the pneumococcus and the bacterium coli communis are found.

Pathology.—*Serous Form:* There is a large outpouring of serum which is clear, and there is a small amount of fibrin associated with it. When recovery takes place the serum is absorbed. Adhesions usually follow.

Fibrinous Form.—The peritoneum is intensely congested, the blood-vessels injected, and a large amount of fibrin is thrown out with very little serum. The pathological process corresponds to that condition seen in fibrinous pleurisy. Firm adhesions resulting in the formation of connective-tissue bands usually remain.

Purulent Form.—A large amount of lymph and pus are present with the usual evidences of inflammation. The abscess is rarely localized or isolated from the rest of the peritoneum by a thick wall of fibrin. Spontaneous evacuation of pus through the vagina, rectum, bladder, or umbilicus has been reported. Such cases may recover. As a rule, purulent peritonitis is fatal.

Symptoms.—The symptoms of fever, vomiting with pain, and uniform distention of the abdomen are usually present. There is also tympanites, and when liquid is present fluctuation can be felt. The child is usually found flat on its back with the legs flexed. Diarrhea exists in some cases, constipation in others. The child appears very sick and suffers continuous pain. The following case will serve as an illustration:—

Jessie M., 2 years old, had typical symptoms of influenza. There were coryza, sneezing, and a temperature of 104° F. At this time there had been a house epidemic, and all members of the family were suffering with influenza. The child had anorexia and vomiting, and cried continuously as if in pain. The abdomen was distended, and constipation reported. A soap-water enema was ordered, and, although a good result followed, the crying continued. The abdomen was tympanitic on percussion and the uniform distention continued. An ice-bag was ordered, but gave no relief. Local applications of warm poultices seemed to afford relief. Chamomile injection at a temperature of 103° F. were ordered given into the colon. When the same passed off another injection of 8 ounces of warm olive-oil not only relieved the child, but produced sleep. These injections were repeated three times a day. Codeine with calcined magnesia was ordered to relieve pain and for the antifermentative effect.

Feeding.—Whey was given every four hours. The disease lasted about two weeks. The child recovered.

Prognosis.—This disease is frequently fatal, especially the purulent variety. The most favorable cases are those in which there is a serofibrinous exudation. The outcome depends on the vitality at the time of illness.

Treatment.—Warm applications have served me best, although some authors, especially the Germans, prefer ice. Hot, moist flannels to which 15 to 30 drops of turpentine have been added will usually relieve tympanites. Codeine should be given until the child is comfortable, $\frac{1}{10}$ to $\frac{1}{5}$ grain, every two hours or oftener. My results have been best when milk was omitted. Soup or broth may be given. Whey is valuable in this condition; also white of raw egg well beaten with sweetened water. The treatment described in the clinical case above cited is my usual method adopted. The high colon flushings are cleansing and soothing. When great prostration exists, instead of using chamomile tea and warm olive oil, normal saline solution has a more toning effect. Special symptoms, such as collapse, require strychnine, nitroglycerine, or caffeine sodium benzoate. Oxygen if cyanosis exists.

Operative Treatment.—If symptoms of appendicitis exist, then an operation may do good. If a sudden collapse is noted perforation should be suspected and the surgeon consulted at once.

CHRONIC PERITONITIS (NON-TUBERCULOUS).

Many authors doubt the existence of a non-tuberculous peritonitis. Henoch believes that we have a distinct variety of chronic peritonitis which bears no relation to tuberculosis.

Symptoms.—In a distended abdomen associated with ascites the liquid can be made out by palpation. There may be diarrhea or there may be constipation. Dyspeptic symptoms are always present, and there is a slight rise of temperature. There are no other symptoms of tuberculosis, and as a rule no other complications present. Anemia is usually very marked.

A child 8 years old was bottle-fed and rachitic. He had suffered with a very severe acute milk infection, resulting in cholera infantum and peritonitis. The child developed symptoms of athrepsia infantum. Several years later the child had a swollen, tympanitic abdomen and a wave of fluid could be made out by careful palpation. I aspirated about 1 pint of a yellow serous fluid. The same was examined and no tubercle bacilli or other bacteria were found. The condition improved. The case was seen by me twice a month, and it was necessary to tap the abdomen each time to relieve distention. The child was under observation about six years. During this time large doses of iodide of sodium, codliver oil, and iron were ordered. A change to the country seemed to do the most good. The child is well today.

TUBERCULOUS PERITONITIS.

The peritoneum frequently participates in a general tuberculous condition. It may, however, be an entirely independent disease; that is, it may occur as the primary lesion of tuberculosis. Biedert[1] collected a series of 883 autopsies on tuberculous children of various ages. He found the peritoneum affected in 18 per cent. The disease may be either acute or chronic.

Pathology.—In tubercular peritonitis the lesions are those of a general miliary tuberculosis. There are usually not very many tubercles scattered through the peritoneum. When the ascites is present then the tubercles are far more abundant. The omentum and mesentery participate in the tuberculous process. The liquid present may be brownish-colored serum containing blood; it may be serous or yellowish and contain pus.

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[1] Jahrbuch für Kinderheilkunde, xxi, p. 178.

The fibrous form usually shows adhesions between the loops of intestine or between the intestine and the abdominal wall. In the ulcerative form there is usually a fibrinous exudation. This form usually follows the miliary or fibrous variety.

Symptoms.—Well-marked evidences of peritonitis can usually be made out when ascites and tympanites are present. When fever is associated with it in addition to evidence of cough or other physical signs in the lungs, then the diagnosis is not doubtful. Sometimes the tubercular or non-tubercular forms of chronic peritonitis will render the diagnosis very difficult.

Differential Diagnosis.—Cirrhosis of the liver may cause an ascites. It is rare in very young children. If the history of syphilis is given the same may be suspected. In some cases a diagnosis can only be made when an exploratory puncture is made and the fluid examined. Even then the diagnosis may be difficult. The only method then left is to make a microscopical examination of the fibrous nodules or rarely by inoculation experiments. The following cases represent tubercular peritonitis:—

M. B., female, 2 years old, was brought to me with a history of cough, distended abdomen, and severe constipation alternating with diarrhea. The appetite was poor, and the child had lost considerable in weight and had not been well since an attack of measles which occurred about one year ago. Evidences of tuberculosis were made out. The stool contained mucus. Tubercle bacilli were frequently found in the mucous discharges. A cavity could be made out at the left apex. The child suffered with recurring pleurisy. The chest contained a large quantity of liquid effusion for over four months. Nine ounces of a thin, greenish fluid were aspirated from the left side of the thorax. Examination showed tubercle bacilli and also streptococci. The abdomen was enormously distended, and a wave or distinct thrill of liquid could be felt by transmitted palpation. Extreme dyspnea was caused by the pressure of this liquid on the diaphragm. By aspiration I removed 1000 cubic centimeters of a yellowish serous liquid from the abdominal cavity. Temporary relief was afforded, although the abdomen refilled very rapidly. It was necessary to tap the same once every six weeks. The child finally died of exhaustion. (See Fig. 106.)

A second case occurred in a little girl, Katie B., about 9 years old. The same symptoms as I have described in the previous case were found, general tuberculosis with especial pulmonary manifestations and symptoms of peritonitis. In this case I aspirated over 3 pints of liquid from the abdominal cavity. The child gradually sank and died several months later.

Prognosis.—When ascites is present the prognosis is not good, especially if operative measures are undertaken. As a rule cases end fatally.

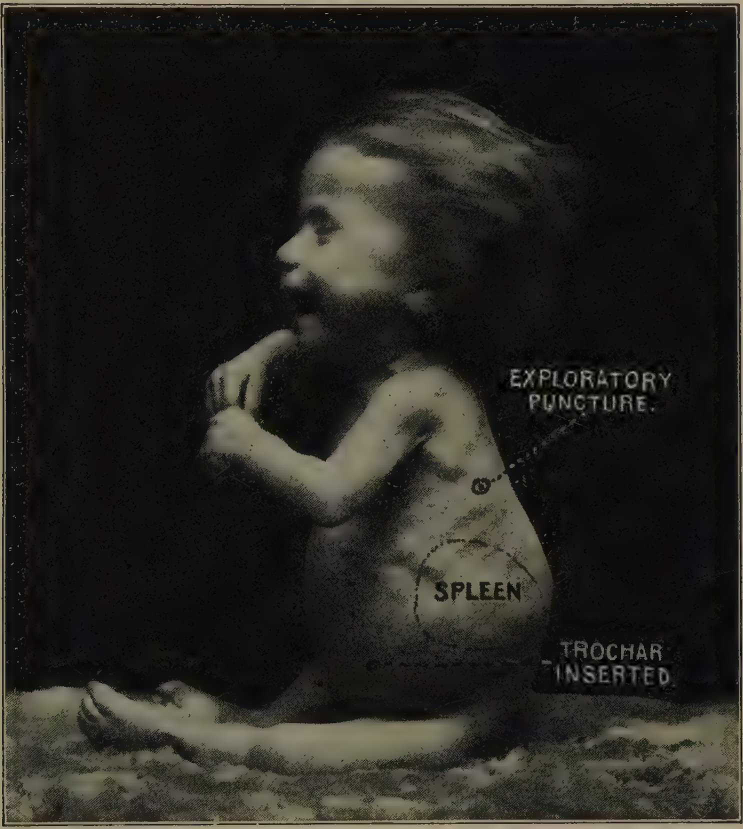

Fig. 106.—Case of tubercular peritonitis complicated by tubercular empyema. Enlarged spleen. Rachitic bottle-fed infant.

Treatment.—Heliotherapy is giving the best therapeutic results. In various parts of the world pediatrists report excellent results where the sun's rays are combined with an out-door life. The penetration of the rays has accomplished most good in the early stages of tuberculosis. The influence of rest, fresh air and food are the most important factors in the treatment.

For a number of years laparotomy was advised as the best method of treating tubercular peritonitis. Many successful cases were reported. It was believed that after the abdomen was opened, drained, and sunlight admitted this latter agent aided the healing process.

Light Treatment.—Not very long ago I saw a case of tubercular peritonitis (non-operative) which was progressing very nicely. It was under the treatment of direct sun rays, besides receiving an electric light bath for ten minutes each day. The influence of light has in recent years demonstrated its value, especially in tubercular manifestations.

A very interesting monograph on this subject has been published by Aldibert, of Paris. Baginsky extols the value of operative procedures in tubercular peritonitis. The reader is referred to modern works on surgery for exhaustive data on this subject.

The general treatment consists in restoratives, building up the body by nutrition, and by tonics when possible.

ASCITES.

This is an accumulation of clear serum in the peritoneal cavity. When it is very severe there is, in addition to the uniform distention of the abdomen, a superficial enlargement of the veins. This is especially noted around the veins of the umbilicus.

Causes.—Pressure upon the vena cava, or chronic heart or lung trouble, such as pleurisy, may give rise to ascites. In extreme leukemia, anemia, cirrhosis of liver, or kidney disease ascites may be present.

Diagnosis.—The fluid can best be made out by tapping the abdomen and noting the transmission of the wave. On tapping the abdomen with one hand and pressing the other firmly against the opposite side, a wave of fluctuation can be made out.

The *symptoms, prognosis,* and *treatment* will be considered in the article on Ascites Due to Peritonitis.

ASCITES DUE TO PERITONITIS.

In the majority of cases ascites is caused by tubercular peritonitis. This condition resembles in its clinical and pathological aspects subacute or chronic pleurisy with effusion, or subacute pericarditis.

Etiology.—No definite cause and no specific agent has yet been determined. Most of the cases are associated with or follow rheumatism, measles, or exposure to cold, and in rare instances injury to the affected parts. It is also seen associated with diseases of the kidney, liver, and intestines.

Pathology.—The pathological lesions are very few. The effusion is usually of a greenish color. In addition to the serum there is fibrin, and in some instances adhesions occur. In some cases all the serous membranes of the body seem to participate and show evidences of an inflammatory condition.

Symptoms.—The early symptoms of ascites consist of general malaise. A child will have a poor appetite, complain of headache and sometimes constipation. In other cases diarrhea may exist. Pain is not present as a rule. The abdominal distention comes on gradually and progresses. The distention is usually the first symptom noted by the mother. The fluid can best be made out by tapping the abdomen as described in the foregoing article on Ascites. Fever is usually absent, although there may be an evening temperature of 101° F.

Prognosis.—The prognosis is fair as a rule. I have seen many cases of ascites recover, leaving no trace of the former trouble behind. A cautious prognosis is advised if a tuberculous process is suspected.

Treatment.—*General Treatment.* Such children must be put to bed. The diet should consist of concentrated liquid food. No solid meats should be permitted. Milk, if not well borne, should be peptonized or fermented. Buttermilk may be recommended. Fresh air and sponge bathing should be remembered as important hygienic factors.

The body should be well protected to avoid chilling the surface.

Treatment of the Effusion.—Small doses of calomel or podophyllin may be given until liquid stools are produced. Diuretics such as cream of tartar, lemonade, or diuretin, in 5-grain doses, will stimulate the action of the kidneys and thus lessen indirectly the serous effusion in the abdomen.

Iodide of sodium in 3- to 10- grain doses should be given three times a day to promote absorption. It may be combined with iron in the following manner:—

℞ Ferri et kali tartrate	1 dram.
Sodium iodide	1 dram.
Elix. of lactopeptin, q. s. ad	2 ounces.

Sig: One teaspoonful three times a day.

Tapping the Abdomen.—Aspirating the liquid by means of a trocar and cannula is a valuable means of emptying the liquid. It is especially indicated if symptoms of dyspnea due to pressure on the diaphragm are noted.

If relapse occurs and the liquid continues to accumulate after several aspirations, then surgical treatment will be necessary. The occasional good results seen in tubercular peritonitis after a laparotomy should be remembered.

VI.

DISEASES OF THE GENITAL ORGANS.

HERNIA.[1]

HERNIA is occasionally seen in the newly born baby. It is overlooked in a good many cases until the size of the hernia indicates that something is abnormal, as there are no special symptoms (see article on Hygiene of the Infant in the chapter on the Newly Born Infant).

In congenital hernia proper, anatomical conditions favorable to visceral escape always tend to permanent spontaneous cure in infancy and early childhood. At birth the spermatic vessels are deeply covered by a thick layer of adipose tissue. The dartos and cremaster are then highly developed, giving the scrotum dimensions quite out of proportion in size to what they are in adult life. Serous cysts of the tunica spermatica and of the tunica vaginalis being very common, this condition also with the scrotum fullness may simulate hernia so closely that it is only by a most painstaking examination we are enabled to exclude them. On the other hand, a small fringe of omentum may come down with the cord and be completely overlooked.

Thomas H. Manley, in his monograph on "Hernia and its Treatment," says: "The prevalent custom of applying a band or binder around the abdomen should be condemned. It conserves no useful purpose; the only excuse for it at all is that it retains the envelopes of the funis in position. If this firm, inelastic compression does not in many cases directly cause hernia in those predisposed to it, I am confident it often very seriously interferes with spontaneous cure, by the increasing pressure which it produces against the abdominal walls. In the herniated infant this, then, should be cast aside, the dressing for the navel string being held in position by adhesive straps or tapes passed around the body. After the desiccated remnant of the cord has dropped off nothing whatever in the way of a girth should be worn around the abdomen, but the garments, when the erect attitude is taken, should be all carried from the shoulders, thereby the feeblest possible action being given to the diaphragm and the organs of digestion. Occasionally we see one side of the scrotum occupied by a hernia before the testicle has descended. Congenital hernia is very rare in females. In the female the umbilical hernia is more common.

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[1] For Umbilical Hernia see chapter on Diseases of the Intestines.

Causes.—A calculus in any portion of the urethra or a phimosis or atresia of the urethral canal may cause powerful contractions of the abdominal muscles, resulting in a hernia. Coughing, especially whooping-cough, frequently produces hernia. Constant straining efforts during constipation or when diarrhea persists frequently end in hernia.

Symptoms.—In male infants a mass that is soft and round will be found in the scrotum. The testicle, although at times difficult to feel, is usually felt above or behind the swelling. This swelling consists of a loop of intestine; rarely the peritoneum descends with it. By placing the child on its back the swelling can easily be pushed into the abdomen through the abdominal ring. There is always a gurgling sound, which is characteristic of hernia.

Diagnosis.—Hernia is frequently mistaken for hydrocele. Both hydrocele and hernia are sometimes found in the same case. The following differential points are well worth noting:—

TABLE NO. 39.

Hydrocele.	*Hernia.*
1. Translucent by transmitted light.	1. Is opaque.
2. Always dull on percussion.	2. Always resonant.
3. When reduction is possible the fluid passes back slowly and noiselessly.	3. The hernia passes back quickly and gives the characteristic gurgling sound.
4. No impulse on coughing.	4. An impulse can be felt when patient coughs.
5. The ring is empty.	5. The ring is filled with the neck of the protruding gut.

Prognosis.—This is usually good. Children rarely have strangulation as we find it in adults. Most of the cases of hernia seen by me in children recovered with the aid of a properly fitting truss. At times nothing but an operation will cure the case.

Treatment.—The diet should be regulated. If any apparent cause exists, such as prolonged diarrheas with tenesmus, constipation, or cough, the same should be treated. If a whooping-cough exists the proper treatment must be instituted before a mechanical appliance is ordered. This consists chiefly in relieving the hernia with a truss. My own experience has been rather good by having a rubber sponge with a rough surface made to include the hernia. This should be held in place by the usual strap going around the body. The leather covered or the celluloid front pads are continually slipping; hence, not so well adapted for children. The hygiene should be well considered in a child. A truss on a diapered infant is a nuisance; it cannot be kept clean; hence, every nurse or mother should be instructed regarding the sensitive skin and the danger of causing irritation from moisture. Every mother should be taught to watch the infant when it cries or strains to prevent the truss from slipping.

Surgical Treatment.—With modern aseptic methods there is little or no risk in an operation. The success of the Bassini operation is so uniform that I have seen dozens of children operated with no fatalities. For the details of this surgical method I would refer the reader to text-books on surgery.

HYDROCELE.

The testicle in its descent is surrounded by a serous membrane described by some authors as a serous pouch. When this pouch fills with serum it is called a hydrocele. Normally a few drops of serum are found in the tunica vaginalis propria. Larger accumulations are met with in more than 10 per cent. of male infants, mostly on the right side, seldom on both. In the majority of cases there is no longer a communication with the abdominal cavity. When it remains a hernia may complicate the hydrocele and the diagnosis be more difficult, because the fluid is apt to return occasionally into the abdomen. Spontaneous absorption is not very rare, but suppuration is uncommon.

Treatment.—Under aseptic precautions a sterilized needle or trocar should be introduced. By this means the serum can be removed. This simple method has frequently resulted in a cure. When the hydrocele fills up again the injection of a few drops of tincture of iodine or Lugol's solution, or pure carbolic acid after the serum has been withdrawn, will usually prove successful. Operations are rarely required, although they are indicated if this milder form of treatment proves unsuccessful.

ADHERENT PREPUCE.

Congenital agglutination of the prepuce and the glans penis is occasionally reported. The majority of cases seen are *acquired* conditions. Smegma frequently collects under the foreskin when the same is not properly cleaned.

Treatment.—With a blunt probe an adherent prepuce can be loosened from the glans penis. The smegma should be removed and the parts lubricated with albolene or olive oil. The mother or nurse should be instructed to oil these parts and thoroughly separate the prepuce so that new adhesions do not form. If this trouble recurs then circumcision is indicated.

PHIMOSIS.

Phimosis is due to a narrowing or contraction of the prepuce so that the foreskin is prevented from being drawn back over the glans penis. A tight prepuce or an elongated prepuce is a constant source of irritation. Bed wetting is a very frequent symptom of this condition. There is an itching and an irritation which frequently lead to bad habits. The sensitive condition sometimes causes priapism, and this may lead to masturbation. Night terrors and insomnia are frequently caused by this condition. Phimosis is sometimes an exciting cause of chorea and various nervous diseases.

Symptoms.—Such children invariably suffer with anemia. They are peevish and restless and constantly irritable. The main symptoms are a series of irritations caused by the tight foreskin as outlined above. In exceptional instances strong, healthy children may not show any symptoms of this condition.

The following case is typical:—

A boy, 4 years old, has always been in apparently good health. He was breast-fed, well-nourished, and showed no evidence of rickets. His mother complained to me that the child had a "weak bladder," that he could not hold his urine, especially at night. He was restless and peevish, and tossed about in his sleep. On examination I found a phimosis existed. The prepuce did not slip over the glans, and the child cried as though in pain whenever the genitals were touched. I advised stretching the foreskin, and this was done every few days, with some degree of success, for the period of about three months. The child improved. When seen again about one year later the symptoms of nervousness, and restlessness reappeared. I then advised circumcision. The prepuce was removed, the parts were dusted with aristol, and the wound healed *per primam.* Recovery was complete.

Treatment.—The treatment outlined in the case above described is the only one that should be used: First, stretching the prepuce, and, secondly, if this does not afford relief, circumcision.

CIRCUMCISION.

Before attempting circumcision we should inquire regarding hemophilia. Remembering the danger of hemorrhage in bleeders we should be assured that our patient is not a bleeder. The Biffi-Brooks coagulation test will give us the desired information.

After the operation is performed a piece of sterile gauze should be tightly bandaged around the penis. This can be left on at least one day. If any bleeding occurs a few drops of Monsell's solution may be dropped over the gauze on the site of the bleeding. Dusting powders should not be used.

The danger of transmitting disease such as diphtheria, erysipelas or scarlet fever should be remembered, hence the operation should never be performed if a case of this kind is in the same house.

A simple method is to make an incision or cut the dorsum of the prepuce with a scissors. After this incision is made we invariably have another skin to divide, which is the mucous membrane. Unless this is also incised we cannot expect relief from the constriction. As a rule small, cheese-like particles, called smegma, will be found, which must be cleaned away. Occasionally one or more stitches may be necessary to control bleeding.

PARAPHIMOSIS.

This is a condition caused by the swelling of the glans or by an abnormally small preputial orifice.

Treatment.—Have the thumb and finger of one hand pressing on the glans; with the other hand an attempt should be made to draw the prepuce back in position. In some cases immersing the parts in very warm water for several minutes has served me very well. If the parts are very tender a spray of ethyl chloride can be used with advantage before the attempted reduction.

When the parts are very edematous then puncturing the surface to relieve the serum will sometimes yield good results. At times surgical relief may be demanded.

HYPOSPADIAS.

The urethra sometimes opens on the under side of the penis. This is always a congenital condition, and results from an arrest of development of the penis and scrotum; and a failure of the two sides of the scrotum to fuse, produces a formation resembling labia majora.

The treatment is radical—by means of plastic surgery. Results are not always satisfactory and repeated operations may have to be performed.

EPISPADIAS.

In this condition the opening of the urethra is on the superior surface of the penis. It is less frequently met with than hypospadias.

The treatment is distinctly surgical and requires a plastic operation.

CRYPTORCHIDISM (UNDESCENDED TESTICLE).

The testes usually descend into the scrotum during the ninth month of pregnancy. In some children the testicles may remain in the inguinal canal or even in the abdomen.

Cases are frequently brought to the physician in which one or both testicles are still in the abdomen—undescended. Such cases should be supervised and the body built up with nutrition, fresh air, and gymnastics until about the seventh or eighth year. Surgical treatment should then be advised for a radical cure. Mechanical treatment such as the wearing of a truss, is useless and may do harm.

Ralph C. was a well-nourished, healthy child. Was breast-fed and in apparent good health until two years ago. The child was brought to me for the relief of an irritable and restless condition. His mother stated that he scratched his nose and appeared to have a pruritus of the anus. The diagnosis of ascarides lumbricoides was made. While examining the child I found one testicle could be palpated in the scrotum and the other in the inguinal canal. By pressure on the abdomen it would descend. There were no symptoms directly attributable to this condition.

ORCHITIS.

An inflammation of the testicle is a rare condition in infancy. Cases have been reported where injury caused orchitis. In the article on Mumps, orchitis is mentioned as a complication. The treatment consists in rest and ice-cold applications of lead water. Laxatives are indicated to open the bowels and thus help relieve the inflammation.

URETHRITIS: VULVO-VAGINITIS.

Vulvo-vaginitis is a catarrhal infectious disease involving the female genital tract. It is divided into:—

(*a*) Simple or Catarrhal; (*b*) Gonorrheal.

SIMPLE VAGINITIS.

The normal urethra of both male and female children, also the vagina, frequently has a simple catarrh. The symptoms noticed are those of swelling, inflammation and a catarrhal secretion.

Etiology and Bacteriology.—Normally the vagina contains a white diplococcus which is not decolorized by Gram.

In simple catarrhal vulvo-vaginitis we have a white diplococcus which also is not decolorized by Gram.

In gonorrheal vulvo-vaginitis we have a white diplococcus which does not decolorize by Gram, and in addition thereto a yellow diplococcus which is decolorized by Gram (Bumm).

These bacteria are usually found in conjunction with other micro-organisms. They easily stain with a watery solution of eosin and counterstain with an alkaline aqueous methylene blue solution.

The microscopical examination shows leucocytes, epithelium, and various micro-organisms; never gonococci.

Symptoms.—The parts are usually sensitive to pressure.

Children who are old enough, complain of pain on urination, and also urinate very frequently. In very young children it is impossible, in fact unnecessary, to make a vaginal or uterine examination.

This disease may last for months, especially so if the body is in a subnormal condition.

This simple catarrh affecting the vulvo-vagina is highly contagious, hence each case should be strictly isolated.

Children so afflicted should sleep alone.

LEUCORRHEA.

A catarrhal discharge of a benign nature usually of a whitish, pearly appearance, sometimes yellowish, is seen in childhood. It is rarely observed during infancy. As a rule such discharges are caused by an infection of pathogenic bacteria. More often the catarrhal discharge is a sequel to one of the acute infectious diseases such as measles, scarlet fever, diphtheria or influenza. Worms have been known to enter the vagina from the rectum and thus give rise to an infectious catarrh.

This is a very persistent condition and one that requires painstaking care before we can claim a cure. Such discharge will persist in children who are in a subnormal condition. Arsenic given internally in the form of Fowler's solution or arseniate of soda is a good restorative and will aid in stimulating nutrition.

The reaction of the vaginal secretion is acid as a result of the presence of the bacillus of Doederlein. The reaction of a child's vagina before the onset of menstruation is almost always alkaline.

Treatment.[1]—Bulgarian lactic acid bacillus in dry tablet form. Introduce a dry tablet into the vagina and then inject a few drops of sterile water, thus allowing the tablet to dissolve inside the patient. This treatment is to be repeated once a week for three or four weeks. If the discharge was of a non-specific character this treatment will be found very effectual. It simplifies the treatment as it removes the necessity for douching.

GANGRENOUS VULVITIS (NOMA).

This condition is the same as that described as cancrum oris. It is a sequella to measles, scarlet fever or diphtheria.

Devitalized children during toxic infections are those usually affected. The disease begins as a small swollen area, in the center of which, on the labia majora a dark spot is found. This dark gangrenous area spreads and enlarges until it may involve the whole labium. The mons veneris and the perineum have also been affected in rare instances. In one case in which recovery took place, neosalvarsan 0.2 was injected intravenously. The injection was repeated every other day until three injections were given.

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[1] The Treatment of Leucorrhea with Lactic Acid Bacillus—Block and Llewellyn, Jour. Am. Med. Assn., vol. lxix, No. 24, Dec. 15, 1917.

Local treatment consists in the application of tincture of iodine daily. Chrysophanic acid, 5 per cent. solution, has also been used locally. There is considerable sloughing. Some authors advise incision but owing to the low vitality the result is usually fatal. Actual cautery, electricity or acids are not beneficial.

The prognosis is always bad.

GONORRHEAL VAGINITIS.

Gonorrheal vulvo-vaginitis is frequently met with in practice. As a rule it occurs among poorer classes where families are crowded. Frequently the infection is transmitted from the adult to the child by sleeping in an infected bed. Cases are on record where a mother suffering with gonorrheal vulvo-vaginitis has infected her child while sleeping with it.

Mode of Infection.—Direct transmission of infected matter from adults to children has been known to occur. Infected clothing, especially bed linen, has transmitted this disease.

In rare instances the infection has taken place directly during the sexual act. There is a popular superstition that when an adult male has gonorrhea he will be cured by raping a healthy child. An instance of this kind has occurred in my practice.

The slightest abrasion of the skin will permit the entrance of the gonococcus. A case has been reported in which a healthy person was infected by taking a bath in the same tub in which a person affected with gonorrhea had bathed the day previous. It is a well-known fact that the gonococcus will live twenty-four hours, hence these germs will persist in the tub and can transmit infection. For this reason a separate tub should be procured while gonorrheal disease exists.

Bacteriology.—Gonorrheal vaginitis is caused by the presence of the gonococcus. It is necessary, however, to subject the gonococcus described by Neisser to the Gram method of staining. The diplococcus found in the normal urethra can easily be differentiated by subjecting the same to the Gram stain. Normally the gonococcus has never been found in the vulvo-vaginal tract or in the normal urethra.

Complications.—*The Eye:* The danger of transmitting gonorrheal infection by the hands from the genitals to the eyes must always be remembered. That this form of infection is not without danger is well known. At the Riverside Hospital I saw a child that was totally blind, the result of a gonorrheal infection.

The Joints.—We occasionally meet with symptoms of inflammation involving one large joint; this is called monarthritis. An inflammation of this kind usually means gonorrheal infection.

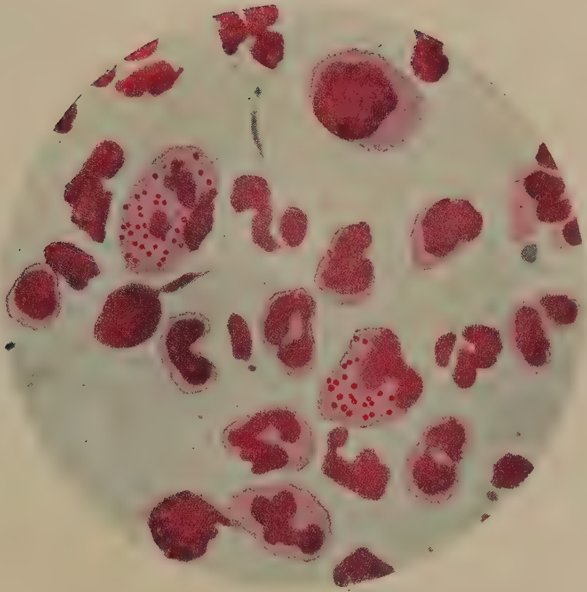
The Heart.—When the gonococcus enters the circulation it frequently attacks the valves of the heart. Valvular lesions are similar to joint lesions; hence we must not be surprised to see cases reported in which a gonorrhea started at the genital tract, entered the circulation, and involved the heart. A case of this kind was reported by Leyden, of Berlin.

Pyelitis caused by an extension of this infection from the urethra may end fatally. An infection may spread from the vagina into the uterus and set up a salpingitis and end fatally. On the other hand, this disease, if neglected, may assume a chronic tendency and cause sterility, so that a guarded prognosis should be given in every case until the infection is modified and the outlook is good. (Read article on Pyelitis.)

Treatment.—*Vaccines:* Autogenous vaccines as well as stock vaccines have been used by me in a great many cases. Beginning with 50,000,000 bacilli the injection may be given daily (read chapter on Bacterial Vaccines, page 575). If no improvement follows the third injection the dose should be increased to 100,000,000. Continue these injections until twelve have been given. My own experience at the Willard Parker Hospital with these cases is that the vaccine lessens the discharge, but does not modify the virulence of the organism. The organism can be found on taking a smear many weeks after cessation of the discharge. We cannot, therefore, speak of a specific effect with the use of the gonococcus vaccine.

Local Treatment.—Irrigate the vagina morning and evening with normal saline solution or with a pint of warm water in which a teaspoon of borax has been dissolved. Five minutes later instill several drops of an 18 per cent. solution of argyrol into the vagina. The instillation is to be done every other day.

PLATE XXVII



Gonococcus. Stained with gentian violet and counterstained with carbol fuchsin according to Gram's method. The organisms are seen to be Gram negative, intracellular cocci.

If after several such treatments no improvement follows then use a fresh 10 per cent. nitrate of silver solution after thorough washing of the vagina and vulva. Nitrate of silver should be repeated no oftener than once in five days.

Systemic Treatment.—The child should be put into the best possible physical condition. Iron, arsenic (1/25 grain arsenate of soda three times a day) or tincture of nux vomica several times a day may be given to aid nutrition and stimulate metabolism. A change of air to mountains or seashore, and when possible ocean baths followed by good, brisk friction will tone the system and aid in throwing off this infection.

VICARIOUS MENSTRUATION.

Some children have a periodical nosebleed, recurring every three or four weeks. In some cases there is a considerable flow of blood, lasting between two and five days. In making the diagnosis it is important to exclude all diseases due to local causes, such as polypus or hemophilia. In one case seen by me (see chapter on Syphilis) fatal hemorrhage resulted in a case of congenital syphilis.

The cause is unknown.

Treatment.—The body should be strengthened and iron given internally. A change of air to the seashore or mountains will strengthen the body and frequently relieve this condition.

MENSTRUATION PRECOX.

We occasionally see girls from 6 to 10 years of age with regular menstruation. Literature records numerous cases of children from 2 to 5 years of age with regularly recurring menstruation. Such menstruation lasts several days or in some instances several hours. As a rule, such children are delicate, tuberculous, or syphilitic.

Symptoms.—There is usually pain in the abdomen similar to colic, restlessness, and a series of nervous symptoms. Such children are hard to please.

Diagnosis.—It is necessary to exclude local causes, such as papillomatous or polypoid excrescences. I have previously referred to hemophilia and to syphilis as a possible cause. Local causes, such as masturbation or traumatism, must be excluded.

As a sequela to acute infectious diseases, we frequently have vaginal catarrh. This discharge may sometimes be mixed with blood. The diagnosis depends on the regularity of the periods, recurring every three or four weeks.

Treatment.—Warm, demulcent drinks and the avoidance of cooling liquids. The child should be kept in bed and warmly dressed.

If the bleeding is very profuse, then 5 to 10 drops of fluid extract of ergot, or hydrastinin hydrochlorate, $\frac{1}{10}$ to $\frac{1}{20}$ grain, three times a day, may be given. An ice-bag over the abdomen will frequently relieve pains and check profuse bleeding.

VII.

DISEASES OF THE KIDNEY AND BLADDER..

THE KIDNEY.[1]

The kidneys of an infant are proportionately larger than in adult life. They are also situated lower than in the adult. The large size of the liver in infancy is the reason for the difference in position of the right and left kidney. The right kidney is situated lower than the left. The suprarenal capsules are much larger than in the adult. After the second year the kidneys assume the position usually occupied by the adult kidneys.

ACUTE NEPHRITIS (ACUTE GLOMERULO-NEPHRITIS; ACUTE BRIGHT'S DISEASE).

Primary nephritis[2] is by no means a rare condition in children. In the majority of text-books nephritis is described as the complication of infectious diseases. It is true that it is most often seen following the acute infectious diseases. In primary nephritis the source of infection is sometimes hard to trace. Pathogenic bacteria can reach the kidneys through the circulation and thus set up nephritis.

Etiology.—The influence of exposure, "taking cold," must be looked upon as an associated factor in the causation of this disease.

Comby explains this as follows:—

In the absence of a specific process, such as scarlatina, diphtheria, etc., we are led, upon the occurrence of acute simple nephritis, to suspect the influence of cold. The action of cold, however, is not always direct. In nephritis, as in pneumonia, cold alone does not cause the disease. It enfeebles the organism, increases its receptivity, augments the virulence of microbes, and opens the gates by which they enter. Children carry within themselves, in the mouth, pharynx, and nasal passages, various microbes, which only await an opportunity of wakening into activity. This opportunity is afforded them by the impression of cold.

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[1] The urine, its physiological and pathological condition, is described in detail in the chapter on Urine, page 1061, vol. ii.

[2] Test for Kidney Efficiency, page 1070, vol. ii.

The sore throat which so often precedes nephritis constitutes a first step toward the invasion by pathogenic microbes. The epithelial barrier is broken down, the micro-organisms reach the lymphatic glands, where they are often arrested or may continue their progress, passing into the circulation, and finally excite a distant inflammation which may be, according to circumstances, a pneumonia, an endocarditis, or nephritis, etc.

In some cases an apparently most trivial angina becomes complicated with swollen cervical glands, and, subsequently, with acute nephritis, etc. Cases have been described as glandular fever, or, in other words, acute adenitis, symptomatic of pharyngeal infection, in which nephritis has developed, superadded to the original disease, which it finally survives. These complications are not fortuitous, but are linked together in strict sequence.

Pathology.—Inflammation of the kidney in a large majority of cases commences as a glomerulo-nephritis, the delicate walls of the capillaries, and their equally delicate epithelial investment being the earliest to suffer; and instead of the non-albuminous urine, one laden with albumen escapes. If the inflammation still progresses, corpuscles, especially the red, make their way out and produce smoky or bloody urine, the naturally high pressure in the glomerulus no doubt greatly facilitating the diapedesis. The casts which may now appear consist for the most part of fibrin, of red and white corpuscles, and of renal *débris,* moulded in the tubes.

The glomerular disturbance is followed by that of the rest of the vascular network and of the gland cells. The latter become swollen and "clouded," and are readily detached. The swollen cells may occlude the lumen of the ducts and press upon the vascular tissue without. Or the capillaries are congested and exudation swells the intertubular tissue. In any case the tissue is enlarged and softened. Sometimes during life the signs of nephritis are well marked, but after death the anatomical lesion appears very slight; in these cases comparison with a normal kidney, both to the naked eye and under the microscope, is invaluable, as then some change can usually be detected.

The kidney of typhoid and diphtheria serve as examples, although there are numerous acute specific diseases which are accompanied by nephritis and albuminuria. The glomeruli are enlarged, owing to swelling of the interstitial substance and to engorgement of the capillaries and often swelling of the endothelial cells; there is in addition an increase in the number of nuclei in the glomeruli. Bowman's capsules may be slightly distended, the endothelium swollen or proliferating, and the spaces occupied by fibrin or white or red corpuscles. There may be an increase in the corpuscles around the roots of the glomeruli. The tubules may be dilated, the epithelium swollen and granular, or there may be some proliferation. Casts are numerous, though usually hyaline; they may consist of blood. Small hemorrhages are frequent, especially in diphtheritic kidneys.

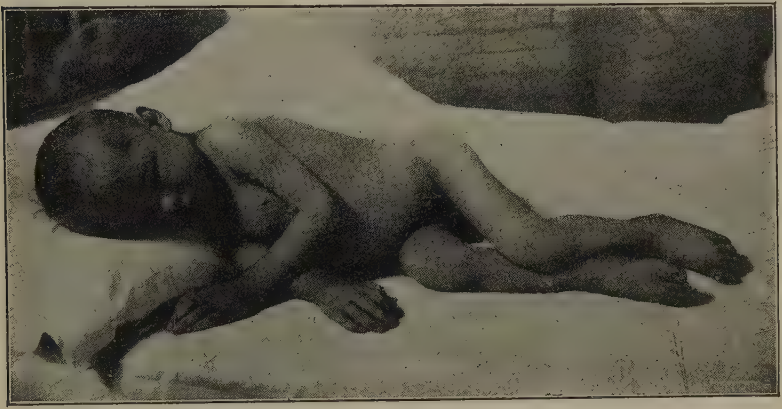

Fig. 107.—Nephritis complicating diphtheria. Note general edema. Case seen by me at the Willard Parker Hospital.

Acute nephritis in the newly born has been described by Jacobi.[1]

Symptoms.—Gastric disturbances, such as vomiting, are very frequently noted. As a rule premonitory symptoms are absent. Nephritis frequently begins with fever, loss of appetite, headache, and general malaise. Swelling of the face is sometimes the first sign of trouble.

The urine is always scanty and sometimes contains red blood-corpuscles, leucocytes, and casts. The urine shows the evidence of acute renal congestion and is *always albuminous.* In grave cases there are frequent efforts to pass urine, and these attempts are attended with pain. With great difficulty the child expels a few drops of dark colored urine. According to the severity of the case these symptoms subside after a period varying from ten to thirty days. Irregularity of the pulse is frequently noted, and should always be looked upon as an evidence of toxemia. It is a grave symptom.

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[1] New York Medical Journal, January, 1896.

The action of the heart should be closely followed in every case of nephritis.

Prognosis.—This is usually good. If treatment is neglected in an acute nephritis, a chronic nephritis will result. In rare instances a general toxemia may cause convulsions and death.

SECONDARY NEPHRITIS.

This disease may accompany or follow diphtheria. It is also occasionally seen in most infectious diseases such as typhoid, measles, varicella, pneumonia, influenza, malaria, meningitis, and empyema.

In a study of gastroenteritis made by Baginsky, the frequent association of nephritis was noted. This author found that the bacterium coli could frequently cause acute nephritis.

Secondary nephritis, following the acute infectious diseases, can best be studied by taking the type most frequently met with, namely, post-scarlatinal nephritis. (See chapter on Scarlet Fever for a complete description of this condition. Note also the microscopical appearance of the urine, in the same chapter, page 719.)

Elaine K., a girl 5 years old, had vomiting, followed by an eruption of scarlet fever covering the entire body. The rash was distinct for three days and then faded. The physician in attendance said it was a case of mild scarlet fever. The child was up and about during the second week following the eruption. The stomach was not carefully guarded, as the child was given a too liberal diet. On the twelfth day from the beginning of her illness she suddenly had what the family called a sinking spell. Evidences of heart weakness were noted. Two days later, or on the fourteenth day of her illness, she was again put to bed. At this time she complained of pains in her joints. The glands of the neck were swollen. The urine was somewhat scanty. On the seventeenth day she had three very severe convulsions.

I saw this case twenty-one days after the beginning of the disease. The diagnosis of nephritis was easily made. Hardly an ounce of urine was passed during the day. The child was edematous and had the waxy appearance seen in acute nephritis. The heart sounds were muffled. The pulse-rate was slow and irregular. The temperature was very slightly elevated, although a severe myocarditis existed. The child was placed in bed, under the care of two trained nurses.

Treatment.—Hot packs, diaphoretics, and diuretin, in doses of 5 to 20 grains, three and four times a day were given. Hot saline colon flushings at a temperature of 105° F. were ordered to stimulate diuresis. A bland liquid diet aided by liquids, lemonade, and cream of tartar, formed the main treatment. The child made a brilliant recovery. There were no complications after the disappearance of the nephritis.

Treatment.—Cream of tartar lemonade, a teaspoonful of cream of tartar, added to a tumblerful of ordinary lemonade, and sweetened. This should be given freely. Another drug that has served me very well is diuretin; this should be administered in doses of from 3 to 5 grains, depending on the age. This can be repeated every three or four hours, depending on the severity of the case. When diuretin is not well borne by mouth, I give it in the form of suppositories per rectum.

The following has served me very well as a diuretic in nephritis when the urine was scanty:—

℞ Potass. citrat.	2½ drams.
Ext. buchu. fluid	2½ drams.
Ext. uva ursi fl.	1 dram 1 scruple.
Syr. limonis	2 ounces.
Aqua	q. s. ad 4 ounces.

Sig.: Teaspoonful every two or three hours.

Calomel or podophyllin, in small doses, 1/20 grain, repeated every two or three hours, is sometimes valuable in this condition. Lithia water and the alkaline waters are generally indicated. An infusion made by scalding the ordinary parsley root (rad. petrosilini), using about one teaspoonful of the chopped root to a teacupful of boiling water, strained and sweetened, can be given in large quantities whenever the child is thirsty. Sweet spirit of niter in doses of ½ teaspoonful, gradually increased, for a child 1 to 5 years old, and repeated every three hours, is a safe and efficient diuretic.

Jaborandi or its alkaloid, pilocarpine, are frequently advised as diuretics. I have frequently seen such cardiac depression follow their administration that I invariably warn against their use. In conclusion, I desire to lay great stress on the weakness of the heart frequently noticed after the administration of the hot-air bath. In one instance the child died during the administration of such a bath.

PERINEPHRITIS.

An acute inflammation involving the cellular tissue which surrounds the kidney, as a rule terminating in suppuration. Some cases may resolve without suppuration.

Etiology.—It may be associated with or due to suppurative process in the kidneys. It is also found in tubercular conditions. The most frequent cause undoubtedly is traumatism. Idiopathic conditions are frequently a distinct factor.

Perinephritis is not of frequent occurrence. Townsend gives the following statistics: Nieden found records of 166 cases. Twenty-three of these were under 15 years of age, the youngest being five weeks old. Gibney reported a total of 28 cases; the ages varied from 1½ to 15 years. In 16 there was suppuration; in 12, no suppuration. In 19 cases no cause was found; in 8 cases a cause was given. Fenwick reports 76 cases: 4 children under 10 years, and 9 between 10 and 20 years, the youngest being 14 months old. Kustre makes a report of 230 cases, 24 under 10 years of age, 17 between 10 and 20 years. Johnson, in an experience of nine years in Roosevelt Hospital, saw but one case in a child, a perinephritic abscess in a boy of 10 following a fall, not complicated by a kidney lesion. Israel, in a report of 43 cases, speaks of one in a patient 12 years old.

Out of 3689 patients treated in the outdoor department of the Children's Hospital for the Relief of the Ruptured and Crippled, in New York, only 6 cases are reported by Townsend.

Pathology and Bacteriology.—As a rule, 80 per cent. of the primary cases terminate in abscess. In secondary cases an abscess is always found. The pathological condition is the same as is found in every acute inflammation. The pus contains either the streptococcus, the staphylococcus, or colon bacillus. In rare instances the pneumococcus and the typhoid bacillus are present. In tubercular manifestations the tubercle bacillus will be found.

Symptoms.—A child that has been in good health will suddenly develop pain in the region of the kidney near the vertebra. The pain extends downward and simulates sciatica. Moving the body increases the pain; hence the spine is generally rigid.

For this reason alone many cases are mistaken for Pott's disease. There will also be fever, the temperature ranging between 102° and 104° F. If the child is old enough to complain, then chills will be noted. In the ileo-costal region there is usually a palpable mass. Children so afflicted will refuse to walk on the affected side, and will limp. They describe the pain as though it were in the groin, in the hip, or sometimes in the knee-joint. If pyelitis complicates, the urine will contain pus. Owing to the passive condition there is constipation.

A. B., 9 years old, complained of pain in the groin and also in the back on the left side. He limped and could not stand on his left leg. He complained of chills and his temperature rose to 103° F. He urinated very frequently. After a careful examination the urine was found to contain nothing abnormal. The boy was put to bed. The bowels were flushed. Owing to small roseolar spots which appeared, typhoid fever was suspected. The blood reaction for Widal was absent. The urine gave no diazo reaction. The pain increased, and after ten days of expectant treatment a swelling was noted in the loin.

This swelling gradually increased in size until it was as large as a hen's egg. A surgeon was called, who diagnosed perinephritis. An incision was made and 2 ounces of pus liberated. The wound was packed with sterile gauze, and, with rest, iron, and strychnine internally, the boy recovered in about five weeks.

Diagnosis.—This condition may be confounded with hip-joint disease, but hip-joint disease develops *very slowly* and has a tendency to become chronic. The symptoms, while very similar in perinephritis, *develop suddenly* from within a few days to a few weeks, and recovery may occur within a few weeks after the first symptoms are noted. In hip-joint disease the symptoms extend over months and years.

The Blood.—An important diagnostic point is the increase in the number of leucocytes, such as we find in purulent conditions in other parts of the body. In tuberculosis there is no leucocytosis unless sepsis exists.

Prognosis and Course.—Primary perinephritis runs an acute short course of a few weeks and usually terminates favorably. Gibney reports 28 cases, all of which recovered.

Treatment.—Rest in bed and a warm poultice over the affected area to hasten suppuration. The abscess should be treated on strict surgical principles. No time should be lost when fluctuation is felt, owing to the danger of pus burrowing into the peritoneal cavity.

Restorative treatment, such as diet, fresh air, iron, and cod-liver oil, should form the basis of the building-up process.

PYELITIS (PYELONEPHRITIS).

Pyelitis is frequently met with in children. Many cases are overlooked because of the difficulty in procuring a specimen of urine. Pyelitis is frequently a sequel to or complication of pyogenic infections such as otitis, streptococcus tonsillitis, endocarditis, and acute influenzal infections.

When fever persists, especially if there is a morning remission and an evening exacerbation, then a purulent infection of the kidney should be suspected and the urine carefully examined. In such cases it may be necessary to catheterize to obtain a specimen. If the catheter is properly sterilized there is no danger of an infection.

Pathology.—Increased pressure in the tubules from obstruction to the escape of urine; reflex irritation of the kidney; the presence of septic matter in the pelvis of the kidney and possibly in the lower parts of the tubules. Most frequently these three causes act, in succession and in the above order, in the same case. As a rule, when acting singly, increased pressure from obstruction will produce hydronephrosis; reflex irritation will excite one of the transient or congestive types of urinary fever; and septic matter in the pelvis of the kidney will cause acute or suppurative pyelonephritis. Increased urinary pressure alone often produces chronic interstitial nephritis as well as sacculation and dilatation of the kidney; but it rarely, if ever, causes acute or subacute interstitial nephritis. Decomposition of urine in the bladder or pelvis of the kidney may produce suppurative changes in the kidneys. If the dilatation of the kidney is not complicated by suppurative pyelitis hydronephrosis results. If it is so complicated, pyonephrosis is produced. Klebs and others believe that bacteria have migrated to the pelvis and calices of the kidney, there to produce their destructive changes, hence the names of parasitic nephritis and pyelonephritis as proposed by Klebs.

Etiology.—A study of the etiology of this disease based on the pathological findings shows that primary suppurative processes in the kidney, such as pyelonephritis, interstitial nephritis and miliary abscesses are descending processes rather than what was formerly thought to be an ascending process. The association of pyuria as a sequel to grippe, angina, and infectious processes in the bronchial tract is very commonly met with. Likewise gastrointestinal disturbances which reduce the immunity of the child predispose to pyelitis.

When a general septic process exists pyuria may result. That bacteria can migrate from the intestinal tract through the lymph channels or through the blood vessels and infect the kidney is well known.

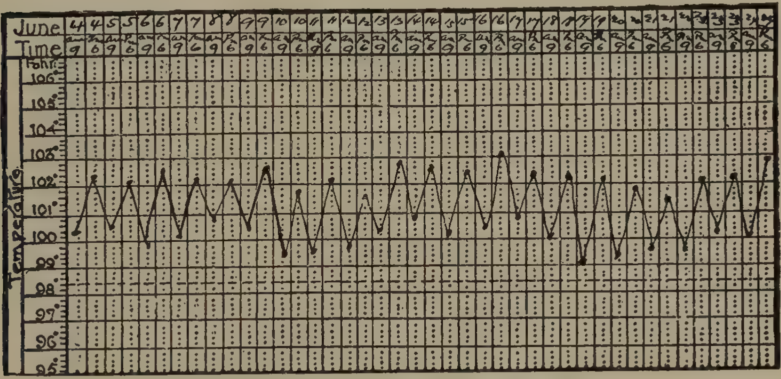

Fig. 108.—Fever curve in pyelonephritis.

Symptoms.—The symptoms are very characteristic in infancy. There is a sudden onset of fever and a general constitutional disturbance in which restlessness, vomiting, and sometimes convulsions may appear. The temperature ranges between 102° and 105° F. It is of a remitting character. If the urine is scanty and there are large quantities of toxic elements retained then uremic manifestations will be seen. Stupor or a semicomatose condition, twitching and general symptoms of sepsis will be noted. At times the symptoms will so resemble typhoid or meningitis that they can only be differentiated by the chemical and microscopical findings in the urine.[1]

In many cases pyelitis is associated with a generalized infection, such as we meet with in influenza, bronchial catarrh, pneumonia, and especially where a tendency to suppurative conditions exists.

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[1] The Spicer urinal described in the chapter on Urine is a very convenient aid in collecting specimens.

Pyelitis is a very common sequel to acute otitis or mastoiditis. Acute appendicitis will give symptoms simulating pyelitis and no case of appendicitis should be operated upon until kidney disease has been excluded.

The Urine.—The urine is usually acid in reaction, rarely alkaline. It is turbid and the sediment consists chiefly of leucocytes.

In the early stages of the disease red blood .cells will. be found. Casts are absent and the albuminous reaction depends on the quantity of pus present. Many colon bacilli, rarely cocci are found.

The skin is of a yellowish-white color, and denotes a septic process.

Course.—It is a long drawn out disease which may last months with a tendency to frequent remission. Occasionally an acute pyelitis may terminate fatally.

Prognosis.—The prognosis is grave and depends on the toxin caused by the presence of the pus. The outcome of the case depends on the disappearance of the pus in the urine, which must be watched for daily.

Treatment.—A child suffering with pyelitis should be put to bed in a cool room having plenty of fresh air and sunlight.

Dietetic treatment such as milk with some alkaline water is useful. No solid food should be permitted. Whey, soups, broths, and fruit juices may be given. Oranges and lemons, owing to their diuretic effect, are valuable. The internal use of Kalak water is also recommended for its diuretic effect.

If we are dealing with an influenzal infection systemic treatment should be given. The salicylates and salol, and small doses of aspirin and 1 or 2 grain doses of guaiacol carbonate are useful. Urotropin, 2 to 5 grains (for an infant half the dose) given four times a day will modify the infection and reduce the fever.

If the urine is acid (coli infection) the following is advised by Albert Niemann, of Berlin:—

℞ Potass citrat,
Natri citrat ....āā 5.0
Aq. destill. 200.0

Sig.: One dram every three hours gradually increased until urine is alkaline.

If the urine is alkaline then 11 drops of diluted phosphoric acid flavored with ½ teaspoonful raspberry syrup and diluted with 3 or 4 teaspoonfuls of water can be given several times a day.

When the urine is acid, urotropin or salol as previously mentioned is indicated. A daily diaphoresis with a hot tub bath followed by blanketing will reduce fever and modify this condition.

When pyelitis continues and is not modified by the usual drug treatment, the urine should be drawn into a sterile container, cultured, and the pathogenic micro-organism isolated. From a pure culture of the same, a vaccine should be prepared and injected every two to three days until improvement is noted.

If we are dealing with a streptococcus or a staphylococcus the dosage of the same varies with each particular organism. As a rule 25 to 50 million is the usual dose. The reaction following the first injection will be an indication as to the increase or decrease in the dose of the second injection.

RENAL CALCULI.

Renal calculi are very common in infancy. They consist chiefly of uric acid. Holt describes a series of brown granules in the pelvis and calices and occasionally a calculus as large as a small pea. Large calculi are rarely met with in this country. Bokai, during the International Congress at Budapest demonstrated four cases with renal calculi in the wards of the Stephanie Hospital.

Symptoms.—As a rule small deposits give no symptoms. In infancy symptoms resembling intestinal colic if continued for some time should cause the suspicion of probable renal calculi. The symptoms of renal colic resemble those seen in the adult. Older children will complain of pain in the loins, down the thigh, and in the male, in the testicles. There is a dysuria and a desire to pass urine frequently, small quantities only, containing blood.

An x-ray of the kidney will detect even the smallest calculi. If continuous pain and recurrent colic suddenly subside the probabilities are that the calculus has reached the bladder. Alkaline waters have a tendency to relieve pain. Locally, an ice-bag over the painful region is beneficial. If the diagnosis is confirmed by an x-ray then surgical treatment is demanded. The risk of shock from the operation is less than the danger of running the risk of impacted calculus in the ureter causing hydronephrosis or pyonephrosis, later resulting in pyelonephritis.

THE BLADDER.

The bladder takes up almost all of the lower portion of the abdomen, as it is capable of marked distention when filled. To make proper physical examination the bladder should be emptied by catheter.

Rotch refers to a distinguished laparotomist who did not empty the bladder of a child before performing an appendectomy; and on opening the abdominal cavity he cut directly through the wall of the bladder. The urine flowing out reminded him of the fact that in early life the bladder is essentially an abdominal organ.

ECTOPIA VESICÆ CONGENITALIS (EXTROVERSION OF THE BLADDER: EXSTROPHY OF THE BLADDER).

This anatomical peculiarity is due to deficient closure of the neutral laminæ causing an hiatus of the abdominal wall. The lower part of the abdominal wall, from the umbilicus or its neighborhood downward, may fail to close, and, coupled with this, there may be deficiency of the anterior wall of the bladder. This constitutes extroversion, sometimes called exstrophy of the bladder. The ureters are plainly visible and the urine dribbles continuously. The child is constantly wet and excoriated from the moisture. The urine is passed in distinct jets or streams, and is especially noticeable when the child cries or strains.

The following case was presented by me to the children's clinic of the New York Post-Graduate Medical School and Hospital:—

A female infant, 1 year old, was breast-fed and well-nourished. Soon after birth the mother noticed a constant dribbling of urine and attention was directed to a swelling situated in the region of the umbilicus. The diagnosis of exstrophy of the bladder was made. A bland ointment was prescribed to relieve the excoriation from the constant dribbling of urine. A plastic operation was performed. The child contracted measles and died of bronchopneumonia six days after operation.

A child in this condition should not be operated upon until 3 or 4 years of age.

INDICANURIA.

A trace of indican is found in the urine in health. A very strong indican reaction should always be regarded as abnormal and hence it is pathological. As indican is derived from indol it signifies a product of decomposition and denotes putrefaction of the proteins. It has also been found in empyema and in extensive suppurative processes where putrefaction abounds. Cases of stagnant feces, constipation, chronic intestinal indigestion, and some forms of putrefactive diarrhea will give a strong indican reaction in the urine. Herter has reported the presence of indican in the urine in cases of epilepsy at the time of the seizures. In the early stages of typhoid fever, when the diagnosis is doubtful, the presence of a diazo reaction and the absence of indicanuria is a valuable aid in establishing the diagnosis.

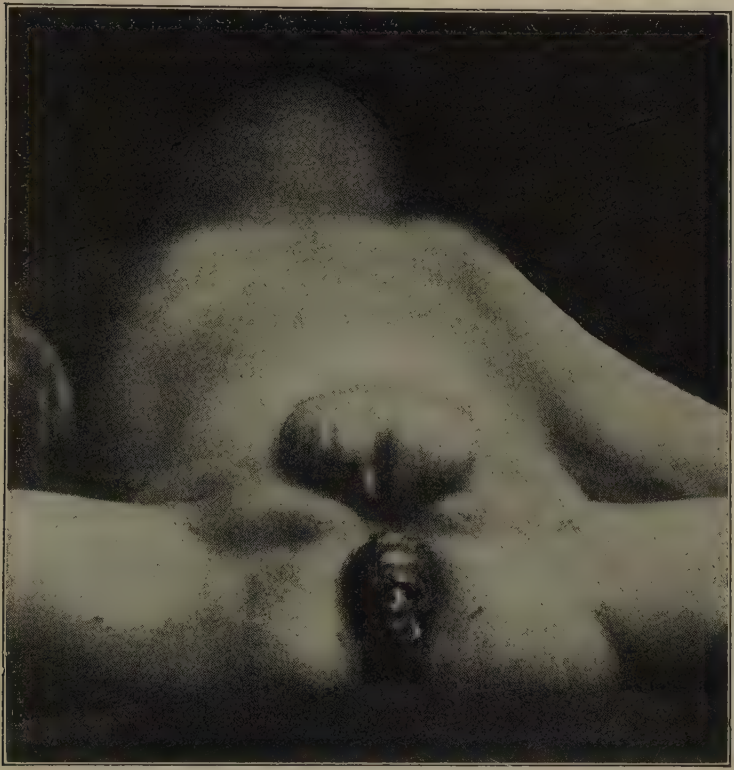

Fig. 109.—Exstrophy of the bladder, and prolapse of anus.

Eliminative treatment such as cleansing the gastrointestinal tract, besides reducing the amount of meat and eggs, will relieve an excess of indican (see article on Intestinal Indigestion).

ACETONURIA—DIACETONURIA.

We are indebted to Baginsky for a careful study of this condition. He found that it was present in children during epileptic attacks. It is also found during the height of fever. He does not believe that acetonuria bears any relation to the nervous symptoms which accompany fever.

Diacetonuria is very common during high fever. It is more frequently present than acetonuria. Binet, quoted by Holt, found diacetic acid in 69 out of 150 examinations in febrile diseases, chiefly in scarlet fever, measles, and pneumonia.

PYURIA.

When pus is found in the urine, it gives a reaction like albumin, namely, coagulates on boiling. Pus cells, however, can be seen only by placing a drop under the microscope, using low power. While pus usually indicates pyelitis or pyelonephritis, it may exude from the ureters, the bladder, the urethra, or the vagina.

Tubercular or suppurative conditions affecting the spine associated with caries of the spinal vertebræ may drain into the urinary tract. It is important, therefore, to locate the cause before treatment is commenced.

Pus from the bladder is always mixed with mucus. It may be acid or alkaline in reaction. The urine containing pus due to pyelitis has an acid reaction. If the child is old enough, a cystoscopic examination should be made. This will aid in excluding the bladder and the ureters as a possible source of the pus.

Treatment.—Demulcent drinks, alkaline waters such as Kalak water have a mild, diuretic effect. Salol and urotropin are the best drugs in doses of 2 to 5 grains three times a day. An important principle, often lost sight of, is that urotropin has an antiseptic value only in an acid medium. Formalin is liberated from the urotropin molecule only in an acid medium, and it is this substance which is the antiseptic, so that it can readily be seen how essential it is to have the urine acid. Should the urine be alkaline, the reaction can be altered by the administration of a few small doses of sodium di-hydrogen phosphate (sodium acid phosphate) per os. Milk, cereals, and fruits should be ordered; meat and eggs prohibited.

LORDOTIC ALBUMINURIA (ORTHOSTATIC ALBUMINURIA).

Heubner has directed attention to the presence of albumin in the urine when children are standing erect. The albumin disappears when the child assumes a horizontal position; hence albumin will be present by day, and will disappear in the urine voided at night.

Jehle, of Vienna, in his monograph published in 1909, has studied this question more closely, and finds a different cause for the presence of the albumin in the urine. He finds that when lordosis is present, and in consequence the lumbar vertebræ offend the kidneys by displacement or pressure, albumin will at once appear in the urine. That this is no theory he shows by producing an artificial lordosis. When in the dorsal position albumin will be found in the urine and disappear when such pressure is removed. This presence of albumin is found in normal kidneys in which no previous scarlatinal or other forms of nephritis have existed. It is, therefore, a mechanical type of albuminuria which can be made to appear during the lordosis and to disappear when the lordosis is corrected.

HEMATURIA (BLOODY URINE).

Hematuria makes itself manifest by the presence of red blood-cells in the urine. It may be due to local irritation or to systemic disease. It is therefore frequently met with during the course of a severe attack of acute nephritis complicating scarlet fever. A case of this kind is reported in the chapter on Scarlet Fever. I have frequently seen hematuria during the course of the hemorrhagic form of diphtheria. I have also seen hematuria in scurvy.

It is important to remember that irritation caused by a calculus in the kidney, the ureter, or the bladder may give rise to bloody urine. Direct injury to the kidney or bladder, or a tumor in the bladder, may cause bloody urine.

The general causes frequently met with are hemorrhagic diseases of the newly born; the blood dyscrasiæ, such as scurvy, purpura, and hemophilia; and infectious diseases, particularly malaria, typhoid, variola, scarlet fever, and influenza. In most of these cases the amount of blood passed is small. When it is large it may appear in the urine as clear blood or as clots, or it may impart simply a reddish or smoky color to the urine. The color, however, is not a reliable guide; the best of all is the microscopic examination. For a simple chemical test guaiacum may be used (Holt).

It is a difficult matter to discover the source of blood in some cases, although large hemorrhage is more apt to result from the kidneys than from the bladder. To differentiate we must rely on the presence of casts from the renal tubules; thus we can satisfy ourselves of the *renal origin* of the hemorrhage.

The prognosis depends on the amount of hemorrhage and the general condition of the child. It should always be regarded as a bad symptom although not necessarily fatal.

Treatment.—The application of an ice-bag or dry cups over the region of the kidneys, rest in bed, ergot, gallic acid, 3 to 10 grains, repeated every three or four hours, or the fluid extract of hydrastis canadensis, in 3- to 10- drop doses, for a child 2 years old, repeated every three or four hours, will sometimes do good.

The food is best given either cool or very cold. If the child is old enough, small pieces of cracked ice or ice cream may be given until the blood disappears.

If the hematuria is due to a tumor such as papilloma, surgical treatment is indicated.

HEMOGLOBINURIA.

Instead of *blood cells* in the urine this condition manifests itself by the presence of *blood pigment* in the urine. Sometimes the urine is blackish. Albumin may frequently be found associated with hemoglobin. The pathology of this condition is at present unknown. It is very easy to recognize the pigment under the microscope. It can also be noted by Heller's test. The most positive method of diagnosis is the spectroscope.

Not infrequently this condition is met with in the infectious diseases, which is evidently due to the effect of the toxins generated by the specific micro-organisms causing these diseases. When an irritant poison, such as carbolic acid, is swallowed, this condition is encountered and recognized, clinically, by the familiar term "smoky urine."

Paroxysmal hemoglobinuria is occasionally met with in childhood. It is usually associated with syphilis. Other cases have been reported.[1]

GLYCOSURIA.

The appearance of sugar in the urine is not necessarily pathological. Grosz published a series of investigations dealing with this condition. He found that glycosuria occurs in nursing infants who have either functional or inflammatory disturbances of digestion. He did not see it in perfectly healthy nursing infants. The sugar found in the urine reacts to Fehling's test; it does not respond to the fermentation test. The polariscope shows that it has the power of dextro-rotation, so that the sugar present is possibly milk sugar or one of its derivatives.

Artificial glycosuria can be produced by administering a large quantity of milk sugar in the food; hence it may be presumed that the sugar excreted in the urine is simply the excess of what could not be absorbed in the system.

Glycosuria was frequently noted by me in the urine of children fed exclusively on Nestlé's food. When this form of feeding was discontinued, the glycosuria disappeared. These cases could therefore be classified under the head of *dietetic glycosuria.*

DIABETES INSIPIDUS (POLYURIA).

This is a very rare condition in children. Its etiology is obscure, although males are more frequently attacked than females. Little is known of its origin excepting that traumatism involving the brain has been known to be followed by diabetes insipidus.

The pathology of this disease is unknown. It is supposed to be a neurosis, but whether the lesion is near the fourth ventricle, or whether its seat is in the renal nerves, has not yet been determined. Cushing and others have brought forth evidence in favor of the view that it is due to a disturbance of the posterior lobe of the pituitary gland, but the evidence is not convincing. Bailey and Bremer (1921) have produced polyuria experimentally by making an incision into the tuber cinereum in dogs, but we cannot be certain that in this brilliant piece of surgery some pathway of nerve fibers was not destroyed that caused the polyuria.

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[1] Archives of Pediatrics.

Symptoms.—Excessive thirst and an excess of urine constitute the main symptoms. From 5 to 10 pints or even more may be passed in twenty-four hours. The urine looks like water and has a specific gravity of from 1001 to 1005. In some cases inosite (muscle sugar) has been found (Holt). Albumin and grape sugar are not found. Urea is excreted in large quantities, whereas uric acid is not. Restlessness by day, headache, insomnia, and marked irritability are the chief symptoms. Unilateral flushes of the face and one ear and similar vasomotor disturbances are present. There is an absence of perspiration. The skin is dry. Development is retarded, especially growth. The appetite remains good. The temperature may be subnormal.

Prognosis.—The disease has been known to last years. Some cases recover spontaneously. As a rule, it is wise to give a guarded prognosis. Cases of diabetes insipidus are very susceptible to other diseases and usually die from some complication.

Treatment.—A very nutritious diet consisting of milk, meat, eggs, and fruit with some restriction as to the quantity of liquid should be made. Restoratives such as Fowler's solution, iron, and codliver oil will sometimes do good. When marked nervous symptoms exist, then atropine, Dover's powder, belladonna and the bromides may be tried. Change of air such as an ocean voyage or mountain air may be of benefit.

Since one view of the origin of this condition is pituitary insufficiency, extract of the posterior lobe (pituitrin) may be given. Pituitrin must, however, be given hypodermically, as it is ineffectual if taken by mouth.

DIABETES MELLITUS.

The pathological studies of Weichselbaum and Opie at the Rockefeller Institute have established the relationship which the pancreas and more especially the islands of Langerhans bear to this disease. The internal secretions play an important part in influencing the metabolism of fat, casein, and the carbohydrates. Congenital syphilis is sometimes responsible for diabetes. Predisposition must also be considered when the tendency toward family diabetes is noted.

Symptoms.—The most prominent symptoms noticeable are irritability and general indisposition, increased thirst with associated polyuria. Sometimes the extreme thirst and polyuria are wanting. Fever seldom occurs. Tenderness is sometimes present over the region of the pancreas. The knee-jerks are sometimes entirely absent during the height of the disease. When a tendency toward slow healing is noted in surgical conditions, then we should suspect glycosuria. Albumin when present is a serious factor. Wegeli found that in 13 cases ending fatally albumin was present. Acetone and diacetic acid are very frequently found in infantile glycosuria.

The urine may vary between 1½ and 10 pints in twenty-four hours. The specific gravity varies between 1.008 and 1.050, The quantity of sugar varies between 1 and 6 per cent., depending on the time of the day and the type of food ingested. Albumin when present is usually a serious complication.

Prognosis.—The prognosis is always grave. When the urine contains diacetic and oxybutyric acids the condition is more serious than when the urine contains sugar alone.

Roughly stated, the duration of the disease may be about six months, although some children linger for years.

Treatment.—Our conception of diabetes has changed since the introduction of insulin. Diabetic coma, acidosis and toxic manifestations will disappear rapidly when insulin in proper dosage is given.

Regarding insulin in infancy and childhood, according to Cowie and Parsons,[1] little danger can come from the administration of insulin to babies with diabetes, because the usual spacings of feedings can easily be taken advantage of to insure sufficient carbohydrate coming into the blood stream when hypoglycemia might otherwise develop. In children no longer bottle-fed the danger might very easily arise because of the inability of the child to announce developing symptoms. However, averting danger in child cases is only a matter of careful management and meal-spacing which will insure a carbohydrate income at these times. The patient should not be allowed to pass from control until the lowest level of insulin intake is established. The beneficial effect of insulin on coma is marked and quite rapid. Infections, such as boils, infected eczema, impetigo, infected wounds, contagious diseases and respiratory infections, occurring in the course of diabetes are overcome rapidly and without apparent harmful effect by insulin. The insulin intake should be increased at these times.

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[1] Cowie and Parsons: Reported before the Am. Ped. Soc., 1923.
[2] *Ibid.:* N. Y. Medical Journal, p. 217, Aug. 15, 1923.

With regard to the beginning of the insulin treatment, after establishing the patient's present tolerance, begin treatment with 2 or 3 units of insulin before meals, covering the carbohydrate and then gradually pushing it up, or give a maintenance diet with 40 or 50 grams of carbohydrate and gradually increase the insulin until this amount of carbohydrate is covered. About 45 units of insulin a day is the average amount necessary to cover a beginning carbohydrate allowance of from 60 to 70 grams a day, but it may take 60 units. The preference, however, at the present time is to begin with small amounts of insulin and work up with a diet furnishing 40 to 50 grams of carbohydrate. After the blood-sugar reaches normal reduce the insulin intake to the smallest amount that will keep the patient sugar-free and the blood-sugar within normal range. The normal blood-sugar range under insulin has not yet been determined.

COLICYSTITIS.

We are chiefly indebted to Escherich for calling our attention to this condition.

Bacteriology and Pathology.—The bacterium coli communis gives rise to this condition. The bacteria can migrate through the female urethra and set up a cystitis. When the intestinal mucous membrane is not intact, as, for example, in catarrhal enteritis, these bacteria can enter the bladder by migrating through the intestinal mucous membrane.

Symptoms.—There is fever and irritability of the bladder shown by tenesmus. The urine contains pus, sometimes traces of albumin, and has a very foul odor. As a rule, the urine is milky or cloudy, or it may be dark in color. In some cases there may be vomiting and headache associated with pains in the bladder and in the back.

Prognosis.—The prognosis is good.

Treatment.—Internally, 3 to 5 grains of urotropin, several times a day, or oleum gaultheria, 1 to 3 drops, three times a day, or salol, 3- to 5-grain doses, three times a day, may be given. The urine must be acid if the antiseptic value of urotropin is to be obtained.

Locally.—The bladder should be washed with a double current catheter. A weak permanganate of potash solution should be used, 3 or 4 ounces being injected at one time; this should be continued until several pints have been used. In some cases irrigations of a bichloride of mercury solution, 1 to 4000, repeated several times a day, may be useful.

URETHRAL CALCULI (VESICAL CALCULI; STONE IN THE BLADDER).

This condition is extremely rare in infancy. It is not so rare in children after the third year, owing to their solid diet. Stone in the bladder is usually composed of uric acid, and is often the result of uric acid infarction in the kidney. In this condition calculi pass from the pelvis of the kidney through the ureters and lodge in the bladder.

Symptoms.—While urinating there will be a sudden cessation of the flow of urine. Pain either in the penis or in the perineum is sometimes described. As has been described (in the article on Cystitis), whenever severe tenesmus exists, causing prolapse of the rectum without definite intestinal trouble, we should suspect trouble in the bladder. Incontinence of urine is sometimes present.

Diagnosis.—If the child is old enough a diagnosis can sometimes be made by inserting one finger into the rectum and pressing over the bladder in the abdomen (bimanual examination). Although this method of bimanual palpation is frequently valuable, it sometimes gives negative results. The surest method is to explore the bladder with a sound. In very sensitive children cocaine may be injected into the urethra before the sound is passed. In exceptional cases, only with the aid of an anesthetic, can a positive diagnosis be made.

Treatment.—Such cases should be treated by the surgeon, although an attempt at crushing the stone might be made. The radical operation of suprapubic lithotomy may be necessary.

Very large calculi have been seen by me in the Stephanie Children's Hospital, in Buda-Pest. Professor Bokai told me that from certain districts in Hungary they receive many cases of large vesical and urethral calculi. It is therefore quite evident that the calculi are intimately associated with the geographical conditions favoring the same.

ACUTE CYSTITIS.

This condition is seldom seen in children.

Etiology.—It is most usually due to the invasion of pathogenic bacteria, such as the bacterium coli and the gonococcus.

It is most frequently the result of an extension of an infection from the external genitals through the urethra into the bladder, so that gonorrhea in children may be an exciting cause of acute cystitis. It has also been known to arise from typhoid bacilli eliminated through the kidneys by the urine.

Stone in the bladder and intestinal irritants, such as turpentine or copaiba, have been known to cause cystitis.

Females are more prone to this affection than males.

Symptoms.—Very frequent desire to urinate, accompanied by pain on urination, is the principal symptom. The urine has a reddish color, but later in the disease has a light color. Its specific gravity is high. The reaction of the urine is alkaline. On standing there is a thick sediment consisting of mucus, pus, and blood. Microscopically, there are pus corpuscles, squamous epithelium, and blood-corpuscles. In females it is necessary to use a catheter in drawing off the urine to obtain a specimen for examination, as the epithelium of the bladder and the vagina are strikingly similar.

Prognosis.—This is invariably good.

Treatment.—Bladder washing with mild antiseptic solutions, such as a 1 per cent. boric acid or bichloride, 1 to 5000, or a weak permanganate of potash solution, is useful in some cases. Alkaline waters in large quantities should be given.

Internally the diet should be regulated so that the child receives milk, thin soups and broths, fruit and fruit juices. Meat and all spices must be avoided. Only bland articles may be permitted.

Drug Treatment.—Urotropin, in doses of 5 to 10 grains several times a day, is very beneficial in an acid medium; or Dover's powder, 1 or 2 grains several times a day, will do good. In very high fever an ice-bag can be applied over the bladder.

CHRONIC CYSTITIS.

This condition is usually associated with a malignant growth in the bladder or frequently by stone in the bladder. It may also be due to a general tuberculosis with special local manifestations in the bladder. The composition of calculi is mainly uric acid, with large quantities of phosphates from the alkaline urine.

Symptoms.—From the constant dribbling of urine the child will have an offensive urine smell resembling ammonia about him.

There is an irritation around the external genitals, due to excoriation from the moisture. If a stone is the cause of this condition the urine will be interrupted while passing and the child will complain of pain. The pain is difficult to localize, although it is described as being at the end of the penis. Girls will localize the pain at the meatus. From severe tenesmus there may be prolapse of the rectum.

The urine resembles the urine of an acute cystitis. Tubercle bacilli are found in the urine in bladder tuberculosis.

Prognosis.—This depends upon the condition of the child and on the cause of this affection. A cautious prognosis is necessary in tuberculous affection, or if a tumor exists.

Treatment.—If a stone or tumor is present the treatment is surgical. Urotropin and salol are very valuable, and I have seen permanent benefit from their use.

℞ Sodium sulpho-carbolate .... 25 grains.

Sig: Divide into 5 powders. One powder every three hours in an alkaline water is also beneficial in some cases.

Bladder washing and the diet as described in the article on Acute Cystitis should be employed in chronic cases.

ENURESIS.

An involuntary emptying of the bladder during the day is known as enuresis diurna. When this condition exists at night it is known as enuresis nocturna.

Causes.—(*a*) Organic; (*b*) functional.

Organic Causes.—Any inflammatory condition involving the urethra or bladder, or diseases of the brain or spinal cord, frequently cause this condition.

Thiemich[1] considers this condition, when occurring in a child who has been clean for months or years, and who shows no sign of organic disease of the urogenital or nervous system, as a sign of that general neurosis, hysteria. In children hysteria usually occurs in a monosymptomatic form. The children who suffer from enuresis at some period usually come of a neuropathic family, and later show some other symptoms of hysteria.

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[1] Berl. klin. Woch., vol. xxxviii, No. 31.

Functional Causes: Adenoids.—It is not infrequent to find that obstructions of the nose and in the nasopharyngeal spaces can cause enuresis. One of the most frequent causes met with is adenoids. It is a safe rule to examine the pharyngeal vault when enuresis exists. My experience has been that over 50 per cent. of the cases of enuresis seen in my clinic have adenoid vegetations.

When there is a general atony of the body, then this condition will frequently result in the weakening of the sphincter vesicæ muscle or in the spasm of the detrusor urinæ muscle. Other conditions causing enuresis are lithiasis vesicalis, and where stones are suspected the bladder must be very cautiously inspected.

Children convalescing from typhoid fever or any long-existing febrile disorders, will usually have enuresis as a result of a general breaking down of the body wherein the muscles lose their tone.

Other conditions causing irritation may be enumerated as congenital phimosis or adhesions of the prepuce, strictures of the urethra; also irritations from worms, such as ascarides, commonly known as pin-worms; fissures of the anus; frequently also in older children masturbation and vulvitis may be considered as possible causes of this condition. (Read article on Lithuria.)

Calcareous deposits in the kidney or stone in the bladder, the overloading of the urine with lithates or phosphates, have frequently caused abnormal irritations resulting in enuresis.

Tight Prepuce.—If other irritations, such as a tight prepuce, exist, then circumcision must be insisted upon. If irritation exists in the urine on account of an excess of lithates or phosphates, then internal treatment must be directed toward relieving this condition. (Read article on Lithemia.)

Prognosis.—The prognosis of this condition is usually good. In obstinate cases it may be valuable to insist on a change of air; thus, removing the patient from the city to the country or to the seashore is of value in some severe cases.

Treatment.—A very bland, non-irritating diet, consisting of cereals and milk, will be indicated. All spices, alcoholics, coffee, and tea must be prohibited. Do not permit liquids to be taken before retiring. It is also important to have the bladder emptied immediately before retiring.

Drug Treatment.—One of the best drugs is strychnine in doses of 1/100 grain, three times a day, gradually increased. In addition thereto small doses, 1/10 grain, gradually increased, of the extract of belladonna may be given. Atropine sulphate, 1/500 grain, increased to 1/100 grain, has had a beneficial effect in some children. When a general atony exists, then nothing will be better than iron given in the form of elixir of quinine, iron, and strychnine. Massage and gentle friction of the whole body, cold sponging, especially of the spine, are valuable adjuvants to the treatment of this condition. A cold douche directed to the spine, especially to the lumbar region, will be found of great assistance.

Fowler's solution and iron are very valuable in weak children.

For incontinence of urine, internally may be given:—

℞ Ext. rhus aromaticæ, fl.	10 minims.
Syrupi aromatici	20 minims.
Aq. destillatæ	q. s. ad 1 dram.

Sig.: This amount to be given three times a day.

The Use of Electricity.—Faradic electricity applied over the bladder, and also over the lumbar region of the spine for several minutes every day, and gradually decreased to every two or three days, is of value in some cases.

According to Thiemich, excellent results are obtained by means of painful faradization, not necessarily of the sphincter vesicæ, but of the arms, back, or thighs. Care should be taken to prevent the impression that the treatment is a punishment, but instead it should be explained that the measure is certain of success, even though painful. More than one application is rarely required if care and tact be exercised. As in all forms of hysteria, isolation and removal from home are the most potent of all remedies.

Mechanical Treatment.—The passage of cold sounds and the dilatation of the urethra by this means are sometimes very effectual. Elevating the foot of the bed is of value in some cases. The child should not be allowed to sleep on its back. To prevent this position it is advisable to tie a towel around the child's body so that the knot is in the center of the back. This will awaken the child if it turns on its back and will compel it to sleep on the side.

By voluntarily, alternately contracting and relaxing the sphincter urethræ, older children should be directed to void a little—about a teaspoonful then stop, void another small amount and then stop again until the bladder is emptied. By this procedure we can exercise and strengthen the muscles which control urination. By this training the patient can be educated until he can continue this slow emptying process by himself.

Thread worms will frequently enter the vagina or locate near the clitoris. These little nests of worms cause irritation, intense itching and occasionally give rise to masturbation. They are a frequent source of irritation of the urethra and cause enuresis. When adhesions of the clitoris exist they should be loosened and the hood of the clitoris cleaned of the smegma or thread worms.

Thyroid extract has been suggested by Williams. He advises ½ grain of thyroid extract twice a day for a child from 2 to 6 years of age. The results are quick if at all. Before administering the thyroid it is a good plan to note whether or not thyroid insufficiency exists.

Atropine in a 1 to 500 solution is extolled by many. Each drop contains $\frac{1}{500}$ grain. One drop can be given twice daily until the physiological effect (dilated pupils and flushed skin) is noted. After two days increase the dose one drop, and increase every two days thereafter until 5 drops are given three times a day.

Lumbar puncture has been advised by some, but has given me no satisfaction.

℞ Atropine sulphate	1 grain.
Aqua	1 ounce.

Sig.: One drop three times a day, gradually increase to 5 drops three times a day.

PART VI.

Diseases of the Respiratory System.

I.

DISEASES OF THE NOSE AND THROAT.

ACUTE NASAL CATARRH (RHINITIS; CORYZA).

INFANTS sneeze normally during the first few days of life, the mechanical irritation of dust in the air being the cause of the same. The great difference between the intrauterine temperature and the temperature of the air renders the new-born baby sensitive and invites respiratory catarrh.

Etiology.—The micrococcus catarrhalis is usually found to be the cause of this condition. Weakened and delicate infants are more susceptible to the development of nasal catarrh. For this reason infants with hereditary disease, such as syphilis, have constant catarrh.

The handkerchief containing dried secretions laden with bacteria frequently disseminates this disease. Children who are too warmly clad and muffled are rendered more sensitive; they are susceptible and usually suffer with rhinitis. Recurring catarrh usually indicates the presence of adenoids. The vault of the pharynx should be explored with the finger for a positive diagnosis.

Diagnosis.—When nasal catarrh is associated with a case of malnutrition and we find flabby muscles, a restless dissatisfied child even though the clinical history does not give a specific history—syphilis should be suspected.

Nasal discharge frequently accompanies frontal sinus infections. When present such discharge through the nose will be accompanied by headache. Older children will describe a pain over one or both eyes corresponding with the course of the frontal sinus. Nasal catarrh may also be an active symptom associated with hereditary syphilis. The lymphatics usually participate, hence we must expect to find enlarged cervical glands in all luctic conditions. A Wassermann is indicated.

In persistent nasal catarrh the vault of the pharynx should be inspected and adenoid vegetations felt for and if such evidence is not present, a blood test is justifiable. A Wassermann test in long-standing rhinitis will occasionally be positive, and if a positive reaction exists then local treatment for rhinitis is wasting time until salvarsan is given. It must be followed by very minute doses of calomel or mercury.

It is important to ascertain the cause of nasal catarrh. A smear taken from the discharge will usually show the preponderance of the specific organism causing the discharge. A culture, however, is the best method of isolating the micro-organism, thus, a catarrhal discharge may be caused by the staphylococcus aureus. It may also be caused by the micrococcus catarrhalis or by the bacillus influenzæ. A very common source of nasal discharge is due to a Klebs-Löffler bacillus or to the streptococcus. As a rule a pseudo-membrane can be seen in the nose or there may be pseudo-membranous patches in the pharynx or rhinopharynx or tonsils. Thus a co-existing diphtheria in the throat with a nasal discharge is usually a positive indication of a nasal diphtheria. If we are dealing with diphtheria then antitoxin should be injected in addition to the local treatment instituted. (Read article on Diphtheria.)

Rhinitis is one of the earliest symptoms of measles; hence the buccal mucous membrane should always be examined for the presence of an enanthem.

If the temperature is high—102° to 103° F.—and there is an eruption, then the possibility of measles should not be overlooked. In all cases of measles the pharynx and tonsils should be carefully examined. Diphtheria of the pharynx frequently has an acute rhinitis associated with it. Pertussis is very often preceded by rhinitis. Inflammation of the lachrymal duct is at times associated, causing acute conjunctivitis. Sometimes the inflammation will extend through the Eustachian tube and cause otitis. In older children deafness is frequently caused by closure of the Eustachian tubes.

Treatment.—*Hygienic Treatment*: Put the child to bed if there is fever, but if the temperature is normal then keep the child indoors in a room with a temperature of 70° F. The body should be warmly clad after having been given a good tub bath, followed by a rub with a coarse Turkish towel.

Rhinitis tablets, containing the following ingredients, for the prophylactic and general treatment of catarrh of the nose and throat, have been used by me:—

℞ Soda salicylate	1 grain.
Tinct. aconite	1 minim.
Tinct. belladonna	1/10 minim.

The above quantity is for one tablet.

One tablet can be given with water every three or four hours to a child 2 years old; smaller children in proportion.

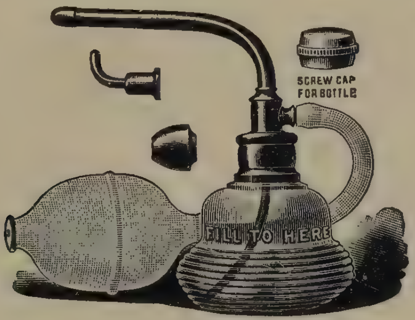

Fig. 110.—Atomizer.

Medicinal Treatment.—The gastrointestinal tract requires cleansing. A dram of castor oil at the commencement of treatment is beneficial. The best drugs are quinine and belladonna given internally. The quinine chocolates, 1 grain of quinine, can be given to a child 1 year old; to an infant 6 months old one-half the dose. Fluid extract of belladonna, 1/16 to ½ minim, three times a day may be given. Salol tablets, containing 1 grain of salol, can be given with benefit every three or four hours.

Local Treatment.—A solution of adrenalin chloride, 1 to 10,000, may be used to cleanse the nostrils in very young infants. In older children a solution of 1 to 4000 may be used for the same purpose.

The discharge can also be removed by irrigating with a 1 per cent. boracic acid or borax solution or a 1 per cent. table salt solution, containing some glycerine, with an atomizer (see Fig. 110) or with Lefferts's posterior and anterior nasal syringe, followed by an alboline spray. The following prescription is useful for the nasal toilet:—

℞ Table salt	1 dram.
Borax	1 dram.
Water	8 ounces.

Aspirin or novaspirin in 1- to 3- grain doses every three hours, depending on the age of the child, is indicated. Locally, the inunction of the following ointment in the nostrils will lessen the thickened nasal secretion.

℞ Pulv. camphor	5 grains.
Pulv. acid boric	10 grains.
Menthol	1 grain.
Vaseline	1 ounce.

Another valuable preparation for cleansing the nasopharyngeal spaces is Dobell's solution.

Dobell's Solution.

℞ Sodium biborate	1 dram.
Sodium bicarb.	1 dram.
Glyc. of carb. acid	2 drams.
Water to make	½ pint.

Cocaine, which is so valuable in adults, should not be used in children. My preference is for novocain. *In older children the inhalation of equal parts of tincture of iodine and aqua ammonia every half-hour will frequently abort the disease.*

Dietetic Treatment.—The nursing infant should be fed at regular intervals. If bottle-fed the same regularity should be observed. No stimulants should be given. It is unwise to give codliver oil or other restoratives when radical treatment is called for.

NASOPHARYNGEAL CATARRH FREQUENTLY ASSOCIATED WITH GASTRIC CATARRH.

The association of nasopharyngeal catarrh with catarrh of the stomach may at first seem peculiar. When, however, the anatomical relationship of the mucous membrane of the nasopharynx with the esophagus and stomach are considered, an extension of the disease can easily be understood. There are certain points which have a decided bearing on the etiology of gastric catarrh when caused by nasopharyngeal disease. Such are:—

1. The fact that children rarely, infants never, expectorate. When they have post-nasal catarrh and there is an irritation

from mucous or muco-purulent secretion infants invariably swallow the same. It is for this reason that the old-fashioned dose of ipecac or castor oil was given, not to relieve the cough nor to hasten the expectoration, but rather to cleanse the stomach from non-expectorated secretion.

2. *Loss of Appetite.*—The loss of appetite, usually associated with severe nasopharyngeal catarrh in which the stomach has been normal up to the beginning of the attack, is usually due to the swallowing of large quantities of this infectious secretion.

The benefit derived from curing a cold with a dose of castor oil simply means removing some of the swallowed muco-purulent secretion from the stomach which should have been expectorated.

When catarrhal disease affecting the nasopharyngeal space is muco-purulent and continues for a long time in very young infants, we can easily see why the loss of appetite may be the means of causing deficient nutrition. Such cases may end fatally. The importance of attending to diseases in the nasopharynx can be seen when it is considered that diphtheria can spread from the pharynx to the esophagus, and also to the stomach.

While it is true that diphtheritic gastritis is reported very rarely, it is well to bear such cases in mind, for they show the great danger to the stomach from an infectious catarrh located at the food entrance. There is usually a deficiency of hydrochloric acid secretion in all severe catarrhal diseases. This is most apparent in those febrile conditions which accompany diphtheria. It is for this reason that it is not very difficult for the stomach to be the seat of an infection if diphtheritic membrane is swallowed.

It is of the greatest importance to have every child's throat in a normal condition. Adenoid vegetations and diseased tonsils favor the development of malignant disease. The vast majority of patients who are infected with diphtheria owe this infection to the diseased state of their throat, which favors the development of pathogenic bacteria. This can as easily be verified in children as in adults. *It is rare to find a case of diphtheria in which a previous normal throat existed. Hence it would seem plausible to eradicate all trifling as well as serious nose and throat disease, and aim to secure a healthy state if we are to ward off infections.*

INFLUENZA.

Influenza is a communicable and a very infectious disease, spreading with great rapidity from person to person.

Bacteriology.—There is no distinct micro-organism or specific agent known to date, which is found in all cases of influenza. Most investigators agree that smears taken from the nose and throat vary in their findings. Kinsella arrives at the same conclusions as MacCallum in studying the pathology of pneumonia. Both state the causative agent is unknown, and that the agent produces a lowering of resistance to bacterial invasion, hence, is followed frequently by pneumonia caused by the different types of pneumococcus, streptococcus aureus, streptococcus hemolyticus, or the influenza bacillus of Pfeiffer. Goodpasture studied a series of bronchopneumonias following influenza in which the hemolytic streptococcus was frequently found.

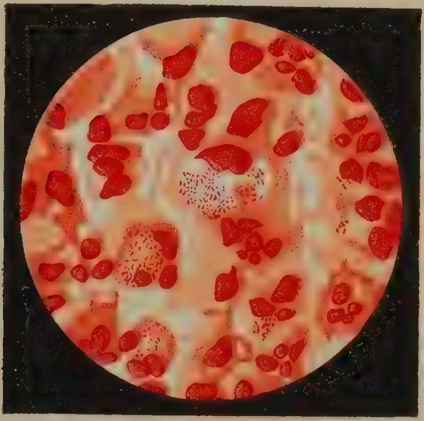

Fig. 111.—Influenza bacilli. Sputum smear. (*Lenhartz-Brooks.*)

Influenza occurs in the most sanitary and best ventilated houses equally as severe as in the most thickly congested dwellings of the city, or in the country. It is disseminated by convalescents—those who have recently recovered and still have the virus or poison capable of reproducing the disease. The catarrhal discharges from the nose, throat, eyes and ears are believed to be factors in the spreading of the disease. Isolate all cases, and during an epidemic quarantine at least two weeks.

Symptoms and Diagnosis.—*The Blood*: In influenza the white cell count shows a leucopenia. In some cases the leucocytes are as low as 4000.

There is also a great similarity of the white cell count, in the blood findings of typhoid fever, and in many instances in which there is prostration, a brown dry tongue, and loose alvine discharges. One is impressed with the similarity of the clinical manifestations.

The Sputum.—In a typical case of influenza which ended fatally the examination of the sputum showed chiefly frothy, blood-tinged serum and mucus with relatively little pus. Staining showed numerous pyogenic cocci including some in chains, believed to be streptococci; also a moderate number of small Gram-negative bacilli, similar to influenza organisms.

The Urine.—The urine in most cases showed traces of acetone, and diacetic acid with a faint trace of albumin, no pus cells nor casts. As a rule the urine was scanty and high colored with a depressed excretion of chlorides. A diagnosis of acidosis was frequently justifiable by the odor of the breath, the intense thirst, and the acetonuria.

Type.—There are three distinct types of this disease encountered; first, the pulmonary type which was met with in nearly 60 per cent. of the cases; second, the gastro-enteric type in 30 per cent. of the cases; and third, the meningeal type or the form in which the brain and central nervous system was affected, in about 10 per cent. of the cases.

Pulmonary Type.—The first symptoms noted are general prostration, cough and fever. The temperature usually ranges between 101° and 103° F. The pulse-rate is accelerated and ranges between 120 and 150. The respiration varies between 30 and 50. Sneezing and rhinitis are present in many cases though not in all. The blood-vessels of the eyes and eyelids are intensely congested and injected. The eyes are dull and frequently sunken. There is a general apathetic appearance. In very young children there is moaning and a short hacking cough. Older children complain of intense muscular pain and lancinating pains in the back, arms, legs and head. The throat is congested, the tonsils swollen and dry. The tongue is coated and resembles a typhoidal tongue. The salivary glands do not seem to functionate. The physical examination of the chest shows one or more small areas of infiltration and patches of consolidation resembling the usual form of bronchopneumonia. In some cases moist râles as well as sonorous râles can be heard on auscultation of the chest. When an area of consolidation is present crepitant râles will be heard at the end of inspiration. On percussion marked dullness will be heard, and distinct resistance will be noted.

E. H., 16 years old, was infected by another member of the family. The first symptoms noted were a slight temperature of 101°, and respiration 28. The subjective symptoms were slight malaise and slight headache, but no constitutional disturbance. The diagnosis of mild influenza was made. Eliminative treatment with a restricted diet was ordered. The following day a slight improvement was noted. I did not see the girl on the third day. On the fourth day I was called and found the temperature rising, more systemic disturbance, prostration, evidence of toxicity, slight headache, muscular pains, respiration 36, pulse 128. Rhonchi were found scattered on both sides of the chest, but no evidence of consolidation. The temperature rose to 105°, and it was impossible to lower it with antipyretics and sponging. A central pneumonia was diagnosed. The inflammation spread from lobe to lobe. When seen in consultation with Walter B. James the diagnosis of influenzal pneumonia with marked toxicity was confirmed. Prognosis bad. On the following day there was an extension of the pneumonia, toxicity still marked, pulse full, bounding, and with high tension, and very irregular. There was marked cyanosis of the lips, face, and finger nails. The expectoration was of the usual rusty character and the specimen submitted was reported upon as follows: "The specimen consists chiefly of frothy blood-tinged serum and mucus with relatively little pus. Staining shows numerous pyogenic cocci including some in chains, believed to be streptococci; also a moderate number of small Gram-negative bacilli, morphologically similar to influenza organisms. Tubercle bacilli are not present."

The blood count showed a marked diminution of the white cells and a low polynuclear percentage. The blood did not show the clinical picture of a leucocytosis in pneumonia. Small lymphocytes, 24 per cent.; large mononuclear cells, 2 per cent.; polymorphonuclear neutrophiles, 56 per cent.; hemoglobin, 86 per cent.

Infantile Pulmonary Type.—In a family suffering with influenza the 2-year-old infant refused its food, showed excessive thirst, and was restless. When seen by me there was coryza, cough, a decided acetone odor to the breath, and prostration. The temperature ranged between 102° and 103°. Owing to the family infection the diagnosis of influenza was made. The lungs showed a few râles on both sides, increased respiration, but no distinct evidence of consolidation. On the following day the temperature rose to 105°. The increased respiration, the toxic condition, the labored breathing, dyspnea, and cyanosis all pointed to a central pneumonia. On the third day of illness distinct bronchial breathing was made out, as were also crepitant râles at the end of inspiration. There was a corresponding increase of temperature, pulse and respiration; and marked rigidity of the muscles of the extremities and neck. The eyes were fixed and the child appeared to be in a state of spasmodic rigidity. There was constant moaning and crying on the slightest touch. This hyperesthesia lasted about four days. On the seventh day of illness there was a sudden drop in the temperature from 105° to 96.4°. The meningeal symptoms gradually subsided and the child made a complete recovery.

Ten cubic centimeters of leucocytic extract was injected on the third day of illness. This appeared to stimulate the white cells, for a decided increase in the leucocytes was evident during the following twenty-four, thirty-six, and forty-eight hours respectively.

Meningeal Type.—In this severe form occasionally seen the toxin selects the brain and central nervous system, and there are symptoms of meningismus and meningitoid manifestations. The diagnosis depends on the findings in the spinal fluid obtained by lumbar puncture. The meningeal symptoms resemble those seen in the diplococcus form of meningitis but are easily differentiated therefrom. The following case shows the intensity of the infection, but one in which recovery took place. A guarded prognosis was given.

M. G., 11 years old, had had a mild form of influenza lasting four days, with symptoms of disordered stomach and cough. Three days before my seeing the child she suddenly collapsed and was in a stupor with temperature of 104°. There was no distinct evidence of meningitis. She recovered with restoratives, and on the following day had a marked delirium. Two days later she was in a distinct coma lasting several hours. When seen by me she was apparently bright in the morning, and in a distinct stupor at the time of examination. There was marked rigidity of the muscles, the pupils responded sluggishly, the patellar and plantar reflexes were absent, there was marked hyperesthesia of the skin, and a tâche cerebrale was present. The symptoms so resembled those of a tuberculous meningitis that a tuberculin test was made, also a lumbar puncture. The Pirquet test was negative. About 15 cubic centimeters of spinal fluid were aspirated. The fluid was normal; no tubercle bacilli or pyogenic organisms were found. The diagnosis of toxic influenza was made. The collapse previously reported was attributed to a toxic myocarditis. There was no nephritis present. The severe toxicity suggested a fatal outcome. The child made a complete recovery.

Gastric Type.—A sudden onset characterized by vomiting and loose bowels, similar to an acute milk infection or a colitis as met with in mid-summer, is frequently seen. Fever ranging between 101° and 104° F., with catarrhal stools containing mucus—at times tinged with blood, with tenesmus and rapid emaciation, occur frequently. Milk is not retained. There is an intolerance for fat, therefore, milk skimmed of all cream, or boiled and strained buttermilk should be given.

The following case is interesting because it was an unusually severe type of gastroenteric infection lasting about nine days, and ending in recovery.

Leonard F., 10 months old, had been thriving, digesting normally, and seemed to be in good health. Suddenly he began sneezing, vomiting, had loose bowels, and cried as though in pain. His temperature was 101°, pulse 124, and respiration 30. Diluted milk was ordered, and a dose of castor oil was given, but the temperature continued to rise to 103°, pulse 140, respiration 38. This was on the second day of illness. On the third day the temperature rose to 105°, pulse 150, and respiration 60. A slight cough developed. Vomiting persisted after each feeding. No medication was retained. There was distinct evidence of consolidation. Barley water was ordered. Cold packs, later cold tubbings were ordered to reduce the temperature. The infant seemed in intense pain, moaning or crying almost continuously, especially on being handled. He shrieked with pain when an arm or leg was moved. The head and neck were slightly rigid. The reflexes were exaggerated. On the fifth day the temperature which had remained at 105°, gradually came down by lysis, dropping one degree each day. The vomiting and loose bowels continued for more than one week. The only milk retained was dry milk, of which 2 tablespoonfuls to 6 ounces of hot water were given every four hours. The interesting feature of this case was the sudden onset of vomiting and looseness of bowels which lasted eight days in all and ceased suddenly.

Complications.—Otitis frequently is followed by mastoiditis and pneumonia by empyema. Suppurative meningitis was seen in two cases. Nephritis is fatal unless detected early. Suppression of urine is a danger signal. Pericarditis and endocarditis frequently follow influenza.

Prognosis.—If a child has been ill three or four days with a high fever and the kidneys show marked toxic nephritis, or the heart sounds are irregular, then a cautious prognosis should be given. Sinus arhythmia is a symptom frequently noted and one showing cardiac muscular insufficiency. In such cases a guarded prognosis is necessary.

Persistent vomiting and associated malnutrition are serious factors to be considered before an opinion is given. When active treatment has been instituted early in the disease, and the

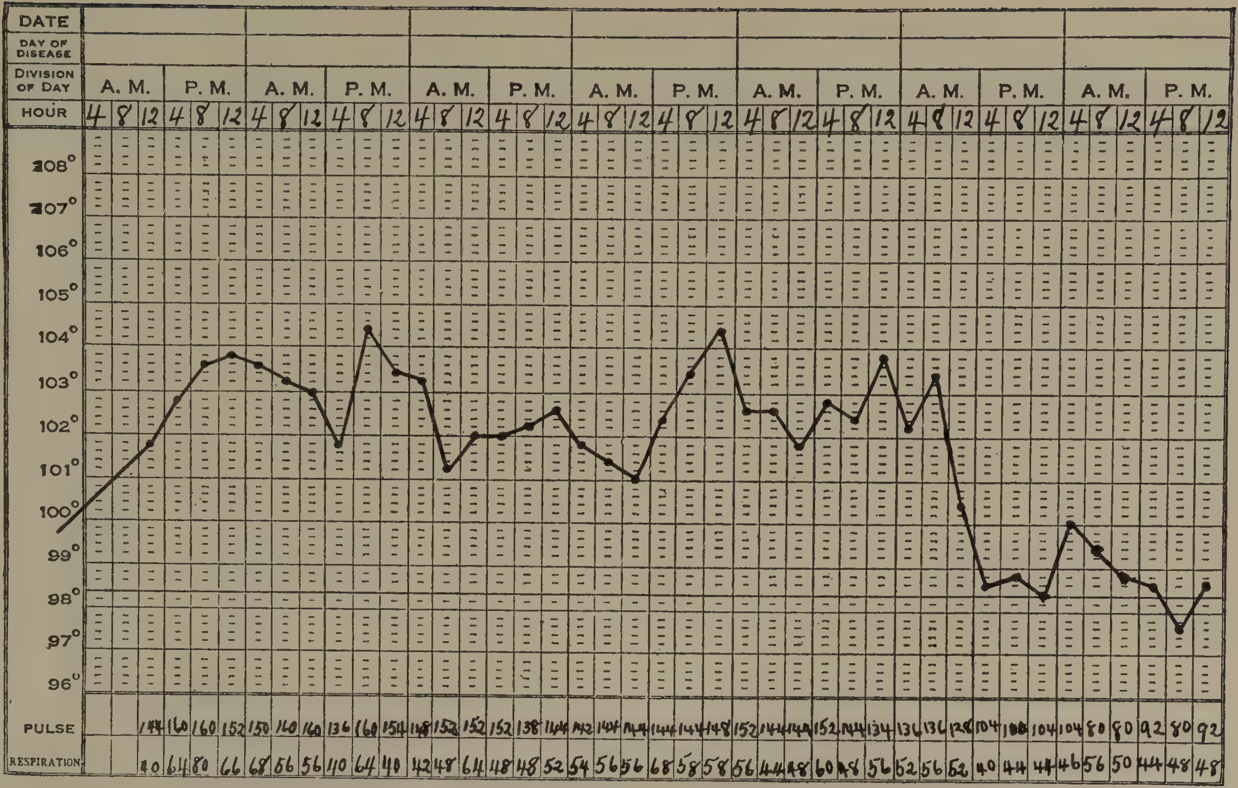

Fig. 112.—Edward K., 10 months old. Influenza, nephritis, Bronchopneumonia. Recovery. Disease lasted sixty-three days.

kidneys, skin, and bowels eliminate the toxin, then a far better prognosis can be given than when the case has received no treatment during the first three days.

Treatment.—Best results are obtained with the alkaline treatment. Five- to 15- grain doses of citrate of soda, bicarbonate of soda, or bicarbonate of potassium may be given, with water, every hour. When the stomach does not retain food nor medication, then six to twelve hours' rest should be ordered, and a colonic injection of 1 dram of soda bicarbonate to 4 ounces of hot water (temperature 102° to 105°) given every three hours. When toxic symptoms exist then an intravenous injection of a 10 per cent. sterile sodium bicarbonate solution should be given in the median basilic or jugular vein. If the infant is under 2 years of age, and the fontanel still open, the longitudinal sinus may be employed as the vein of choice for rapid systemic medication.

To relieve intense neuritis pyramidon in 3-grain doses may be given every three hours. Urotropin in 2- to 5- grain doses several times a day, should be ordered if nephritic symptoms exist. To reduce fever give a luke-warm tub bath, followed by a warm pack and blanketing until profuse perspiration results. This eliminates toxin and reduces fever without depressing the heart.

Food.—Fermented milk such as buttermilk or milk fermented with the Bulgarian bacillus is refreshing and antitoxic. Weak tea containing the white of a raw egg with a pinch of salt, lamb broth or chicken broth may be given in three to four hour intervals. No solid food should be permitted. Orange juice, pineapple juice or apple sauce may be given to quench thirst. When the fever subsides semi-solids may be given.

Vaccine Prophylaxis and Serum Treatment.—My own experience in prophylactic serum injections[1] has shown me that we cannot guarantee immunity by the use of vaccines. In some cases following the vaccine injections no infection took place, in other cases the disease did appear, but in a mild form.

The vaccine does no harm and may modify the intensity of the infection. Do not pin too much faith on the efficacy of these serums and vaccines but use all remedies to eliminate the infection even though serum or vaccine is used.

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[1] My experience was gained with the influenza serum of the New York Board of Health, likewise with the serum sent me by Rosenow of the Mayo Foundation.

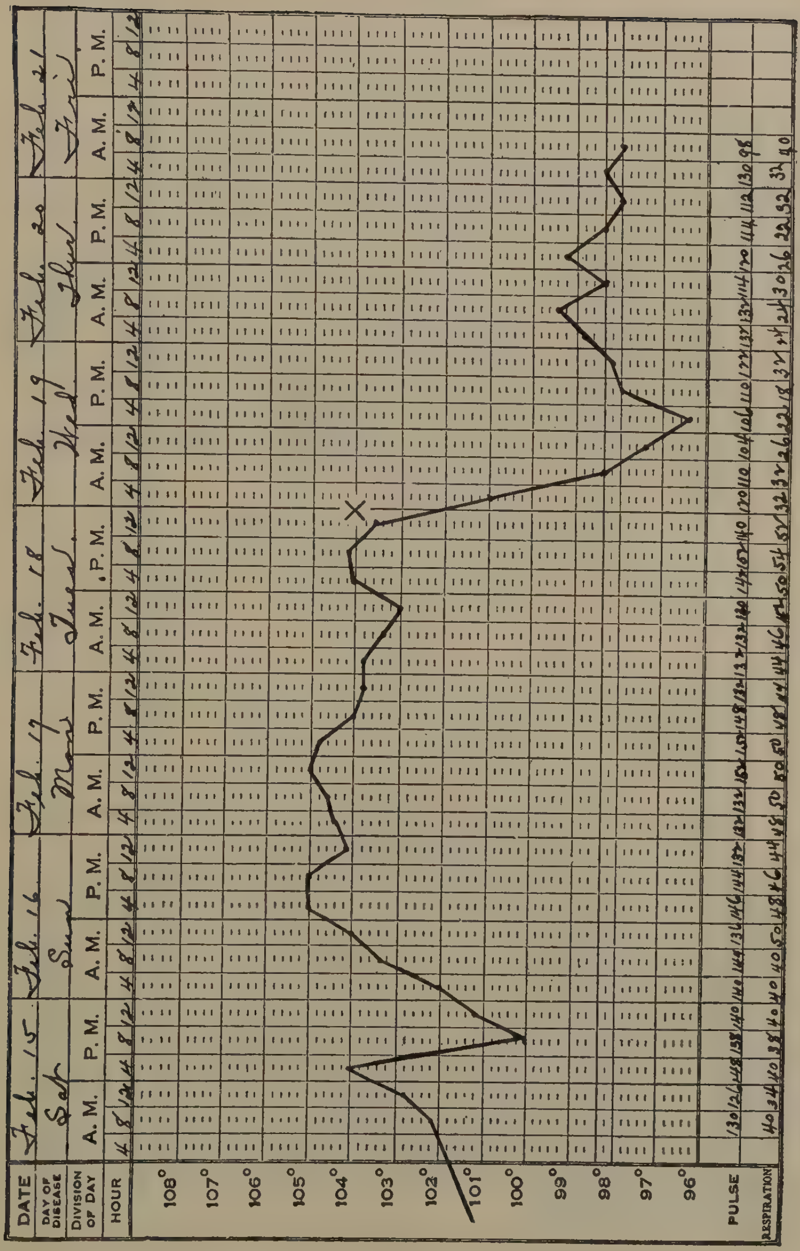

Fig. 113.—Temperature curve in a severe toxic influenza pneumonia, ending in recovery. × Crisis.

Specific results are being reported from the use of bacterial protein injections. The vaccine consists of a saline suspension of heat-killed organisms each containing 100 million influenza bacilli, 100 million pneumococci, Types I, II, and III; 100 million streptococci and 100 million staphylococci.

Edward G. Cary and Dudley Roberts, U. S. Army, report excellent results from the use of influenza vaccine during the recent epidemic.[1] The patients were adults, and being hospital cases under excellent supervision, the results are convincing.

To be effectual the vaccine must be injected intravenously and not hypodermically. The dosage consists of 0.2 cubic centimeter, doubled daily until four doses have been given. Following the injection there is a sharp reaction consisting of a chill and a rise in temperature of 1 to 3 degrees. When this reaction occurs it proves that the body is responding. If there is no reaction then the vaccine is ineffectual.

FOREIGN BODIES IN THE NOSE.

Children frequently while playing with beans, beads, shot, etc., stick them in the nose. If allowed to remain they frequently become encrusted with carbonate and phosphate of lime. Then it is known as a rhinolith. An angular forceps or a polypus forceps has frequently dislodged these foreign bodies. A nasal irrigation into the unobstructed nostril will sometimes assist in removing the foreign body.

ACUTE TONSILLITIS; FOLLICULAR TONSILLITIS (ANGINA CATARRHALIS).

This is an acute inflammatory lesion, undoubtedly due to the infection of the structures of the tonsil by micro-organisms which enter the lacunæ or lymph channels.

Bacteriology and Pathology.—The tonsils are lymphoid structures closely resembling Peyer's patches of the small intestine. Various species of cocci and bacilli are to be found within the lacunæ, within the closed follicles, and even within the epithelial cells of tonsils removed during the acute stage.

The examination of the purulent plugs of follicular angina reveals:—

(*a*) Staphylococcus.
(*b*) Streptococcus.
(*c*) Pneumococcus.

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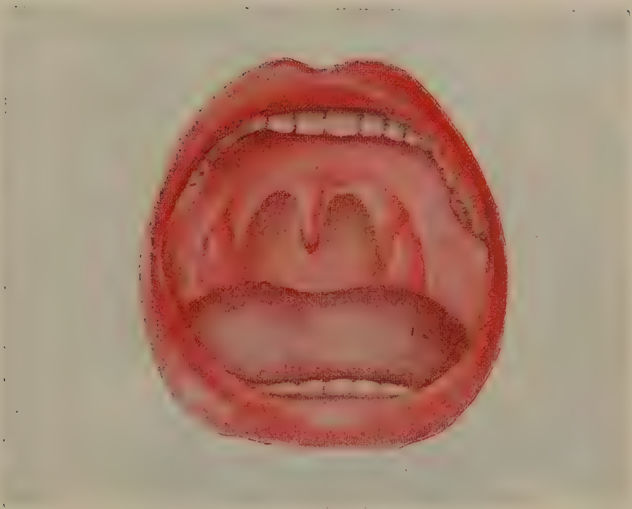
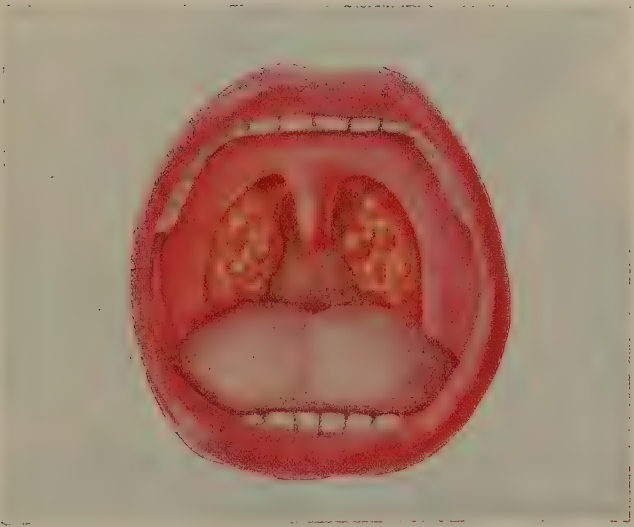
[1] Cary and Roberts: Journal of the Am. Med. Assn., March 29, 1919.

PLATE XXVIII



A normal or healthy throat.



The throat in tonsillitis. Note the yellowish-white spots on the swollen tonsils, hanging between the tonsils is the swollen and congested uvula or soft palate. The tongue appears coated.

Staphylococcus angina is a relatively harmless inflammatory lesion passing off without complications.

The streptococcus variety is a severer type of disease associated with fever and glandular enlargement. This disease is associated frequently with a general toxemia and may be followed by nephritis or septicemia.

The pneumococcus form is usually ushered in with a chill and sometimes runs a course similar to that of pneumonia. There is usually a redness and swelling of the tonsils, lacunar catarrh, and increased secretion, which agglutinates and shows itself at the follicular openings as yellowish-white spots.

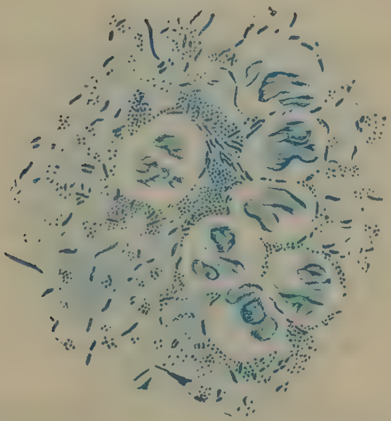


Fig. 114.—Angina tonsillaris. Methylene-blue staining.
(After *Jager,* Klin. Microscopy.)

Leucocytes in large numbers are found associated with the microbes.

During the presence of inflammatory conditions, such as the presence of the contagium of diphtheria, desquamation of the epithelial covering takes place. This proliferation of the cells seen in diphtheria may entirely denude the tonsil of its epithelial covering in places. This will then permit any specific virus to be brought into contact with the lymphatics and then be carried into the general circulation. We see an acute inflammation of the tonsils in scarlet fever, in measles, and in diphtheria. It may also be seen in other infectious diseases, so also in acute inflammatory manifestations.

Symptoms.—One of the most frequent diseases of infancy and childhood is tonsillitis. When we are told that an infant has had a slight fever that passed off very quickly and has been attributed to "teething," tonsillitis among other diseases should be suspected.

The onset is sudden. Fever may be high. The temperature reaches 102° and may rise to 105° F. Vomiting frequently occurs. On the tonsils we find intense redness, and the lacunæ are covered with whitish or yellowish-white spots, which rarely coalesce but appear as yellowish dots.

The lymphatic glands at the angle of the jaw are sometimes enlarged and tender on palpation.

A diagnosis of tonsillitis or quinsy is usually thought to imply that we are dealing with a benign, easy-going condition. That the reverse is true is very apparent when a critical inquiry will follow the termination of each and every case. In a series of 12 cases of follicular tonsillitis taken at random as I saw them, the bacteriological diagnosis in 7 of these cases was diphtheria. A culture should always be taken from the throat and nasopharynx.

The frequency with which endocarditis and nephritis are seen implies that there may have been some antecedent disease from which pathogenic bacteria caused the valvular heart lesion, or possibly a nephritis.

Treatment.—Swabbing the tonsils with tincture of iodine applied lightly, once only, is very effectual. Care must be taken that the swab is not over saturated or it will burn the pharynx and make the child very uncomfortable.

A laxative such as several drams of milk of magnesia, or for an older child half a bottle of citrate of magnesia is advisable. To relieve the temperature a soap suds enema should be ordered. Cool foods, such as ice cream, iced tea, broths, seltzer and milk, buttermilk, and thin gruels can be given.

A cold compress applied externally is very soothing. It should be changed frequently.

CROUPOUS TONSILLITIS.

This is a severer form of inflammation than the one above described. It involves the whole structure of the tonsil and most especially the crypts. The large quantity of fibrin which is poured out forms a distinct pseudomembrane. It is very difficult to differentiate this from diphtheria. A culture should be taken in all cases (see the Diagnosis of Diphtheria).

We cannot differentiate this disease from true diphtheria clinically except by resorting to bacteriological cultures.

ULCERO-MEMBRANOUS TONSILLITIS (VINCENT'S ANGINA).

This disease was first described by Vincent[1] who maintained that it was caused by a fusiform bacillus, although a spirillum was found associated with it.

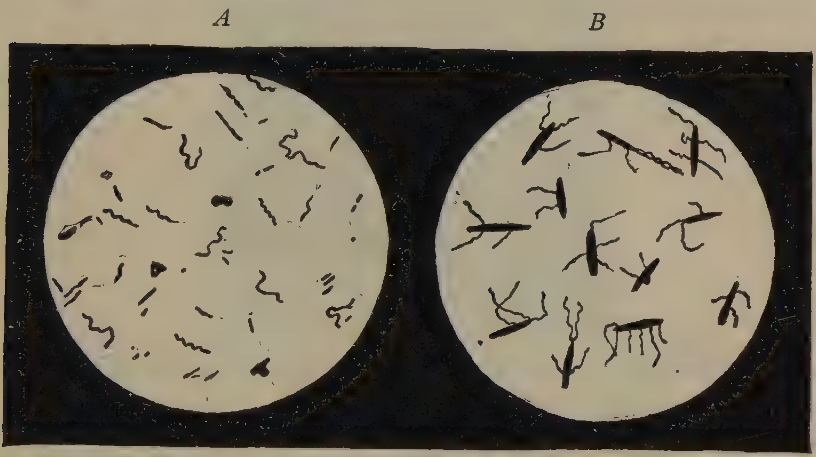


Fig. 115.—Vincent's bacillus found in ulcerative angina. *A,* fusiform bacillus having a thickened center and tapering toward both ends. Also spindle-shaped bacilli. *B,* fusiform bacillus having spores.

Microscopically, there is a spindle-shaped bacillus along with spirilli. The bacillus does not stain with Gram. A clear culture is hard to obtain.

The pseudomembranes, whitish or grayish in color, are easily detachable until the third day, when the ulcer forms. This ulcer corresponds to the portion of the tonsil occupied by the pseudomembrane. Around its edges the mucous membrane is reddened. The accompanying symptoms are difficulty in swallowing, fever, anorexia, headache, and swelling of the submaxillary glands. The pseudomembrane does not increase when this piece of membrane is detached. The ulcer heals.

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[1] VINCENT: Arch. International de Laryngologie, 1898, No. 1.

It resembles croupous tonsillitis in its general appearance. It is often unilateral. The yellowish exudation seen on the tonsil greatly resembles diphtheria. It is a superficial necrosis, and when this tissue is wiped away with a swab bleeding occurs.

There are swollen lymph nodes at the angle of the jaw.

This disease is a local process and rarely has constitutional symptoms accompanying it.

Prognosis.—The prognosis is excellent.

Treatment.—Gargle with mercury bichloride, 1 to 2000, or with a weak solution of permanganate. Locally, iodine, or 3 per cent. peroxide of hydrogen or 10 per cent. nitrate of silver solution, can be repeated in twelve hours if no improvement is noted. By painting the ulceration with a 2 to 3 per cent. solution of neosalvarsan freshly made with distilled water, pains and symptoms quickly disappear.

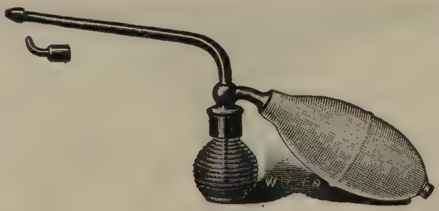


Fig. 116.—Throat spray.

PHLEGMONOUS TONSILLITIS (QUINSY: PERITONSILLAR ABSCESS).

This form of angina is usually caused by an invasion of the staphylococcus. When the cellular tissue surrounding the tonsil is infected the inflammation may terminate in:—

(*a*) Resolution.

(*b*) Abscess.

It is one of the rarer forms of inflammatory conditions met with in children.

Symptoms.—The symptoms are similar to those of follicular tonsillitis. The temperature rises to 101° and 102° F. Sometimes as high as 105° F.

The child, if old enough, will complain of pain on swallowing, and at times it may be impossible to open the mouth. On examining the throat the inflammation can be seen. There is a marked congestion and edema involving the tonsils, fauces, and uvula.

Holt reports a case of torticollis several days before the diagnosis of quinsy was established.

Treatment.—Aconite in 1-drop doses, repeated every one or two hours for the first day, will frequently abort the disease. Guaiacol carbonate given in 1- to 5- grain doses every three or four hours, has served me very well in some instances.

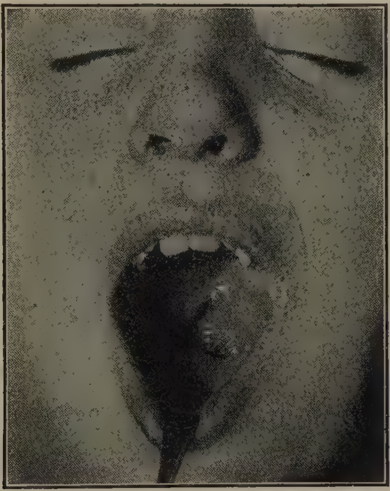


Fig. 117.—Follicular tonsillitis with swelling of the tonsil due to peritonsillar abscess.

Local Treatment.—Local treatment consists in spraying the throat with a 1 to 2000 bichloride of mercury solution every two hours.

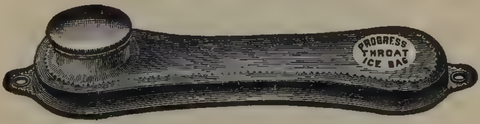


Fig. 118.—Throat ice-bag.

An ice-bag over the neck will sometimes relieve inflammation. The external application of leeches will relieve congestion. When fluctuation is felt the pus should be relieved by making a deep incision with a long, pointed bistoury.

The Danger of Hemorrhage.—Laryngologists, as a rule, advise great caution in operating in this region owing to the large number of blood-vessels located there.

After the incision is made the wound should be enlarged by inserting a polypus forceps or an artery clamp and separating the blades. By this means we can easily evacuate the pus and do not run the risk of bleeding.

ENLARGED (HYPERTROPHIC) TONSILS.

The chronic enlargement of the tonsils is due to recurring inflammatory attacks. This hypertrophy comes from a proliferation of the lymphoid tissue and an increase in the connective tissue stroma.

Etiology.—When recurring attacks of tonsillitis occur gradual enlargement takes place which is a favorite soil for reinfection.

Diphtheria, scarlet fever, measles and influenza have inflammatory changes associated with the infection and this leaves the tonsils enlarged, thereby inviting reinfection.

Poor hygienic conditions of the mouth, especially the teeth, and pyogenic disease in the mouth, gums, teeth or pharynx, cause migration of the staphylococcus or streptococcus into the deeper portions of the tonsil setting up inflammatory changes which remain permanently.

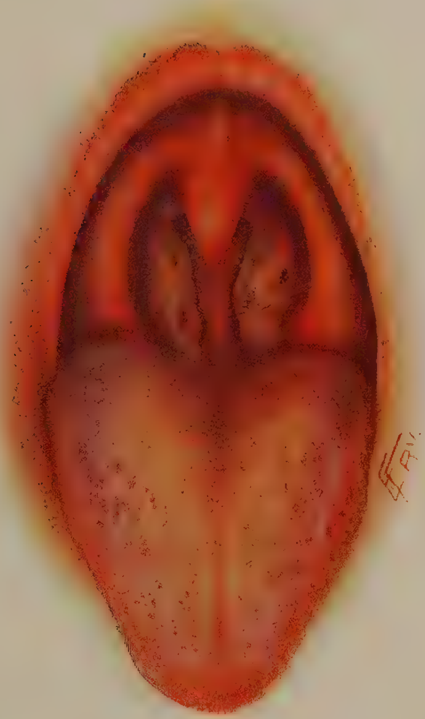
Predisposing causes, such as rheumatism in the parents, have been given by some authors as causative factors.

Symptoms and Course.—When we are told that an infant snores and breathes with its mouth open, then enlarged tonsils may be suspected as the cause. On the other hand an inspection of the post-nasal spaces should also be made to eliminate the presence of adenoids as the probable cause of the difficult respiration.

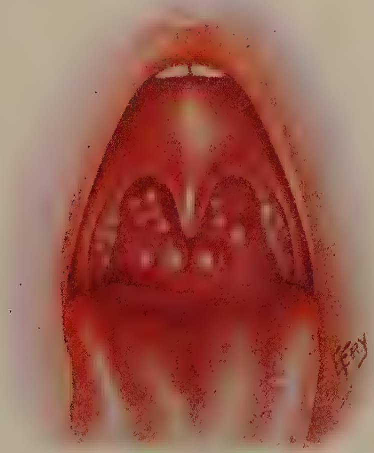
Deafness can rarely be attributed to enlarged tonsils. It is more often caused by the closure of the Eustachian tubes due to adenoids. The nasal tone of voice often accompanies enlarged tonsils.

Enlarged tonsils increase during childhood and remain permanently until puberty arrives, when they usually shrink in size without treatment.

PLATE XXIX



Chronic enlarged tonsils and associated congested throat, very frequently seen.



Granular pharyngitis.

The indications for the removal of chronic enlarged tonsils are:—

1. Where there are repeated attacks of tonsillitis.
2. Where there is inability to breathe sufficiently through the nose, with snoring, during sleep.
3. Nasal voice and deficient articulation.
4. Deafness and attacks of earache.
5. Tendency to pigeon-breast.

When any or all of the above conditions exist then a guarded opinion should be given until we ascertain whether or no the case is complicated by adenoids.

In the latter cases the removal of the tonsils will not suffice to cure the patient until the rhino-pharynx is treated for the removal of the adenoids.

Enlarged tonsils, especially if the follicles are filled with purulent or fibrinous exudate, give rise to a series of symptoms such as fever or general toxemia. Associated therewith, there is usually the enlargement of the cervical glands below the tonsils which can be palpated under the jaw. There is fever, a temperature of about 100° to 102½° for which no other reason can be assigned. Toxic symptoms such as malaise, exhaustion, sallowness, poor appetite and deficient oxygenation are symptoms which demand the removal of the tonsils.

Enlarged tonsils are a menace and the large number of cases of polyarthritis indicates that rheumatic tonsillitis may mean permanent damage to the body.

Endocarditis is frequently a sequel to hypertrophic tonsils and it is our duty to prevent chronic organic complications which may end fatally.

Treatment.—The removal of diseased or enlarged tonsils is, in my opinion, one of the most satisfactory operations in children. There are several points, however, which must be considered before deciding on an operation. The child should be examined to see whether any cardiac lesion exists, likewise should the thorax be examined for the presence of bronchitis or asthmatic bronchitis.

The choice of an anesthetic depends on the condition of the kidneys and lungs. In many cases ethyl chloride is sufficient to produce anesthesia for a tonsillectomy. In many more cases without bronchial or cardiac lesion the ideal anesthetic is nitrous oxide followed by ether. Cautiously given chloroform can be used with safety. I have seen chloroform used by my anesthetist in hundreds of cases of tonsillectomy without any ill effect whatsoever.

Danger of Hemorrhage.—Our first duty while arranging for an operation is to inquire whether we are dealing with a bleeder, and even though we are told there is no hemophilia in the family history we should have the blood examined and note the time of coagulation. If we find that it takes fifteen minutes for the blood to coagulate the child should receive gallic acid in 5 grain powders three times a day for several days prior to the operation.

Roentgen Ray Therapy.—Regarding the latest therapeutic measures we find the x-ray which serves a double purpose in not only penetrating and destroying diseased tissues but also destroying with it pathogenic bacteria. Likewise, radium has been advocated.

The great advantage of the latter agents consists in there being no shock to the system such as operation with an anesthetic and the loss of a certain amount of blood, must entail. It is too early to state whether or not this new method of treating diseased tonsils will take the place of the operation by excision or snare.

In a series of experiments on animals, lymphoid tissues and the circulating lymphocytes were found to be almost completely destroyed.[1]

This observation led to the use of the Roentgen ray in the treatment of lymphatic leukemia and in reducing enlarged spleens and glands occurring in other diseases.

The recent emphasis laid on the tonsil as a seat of focal infection has suggested that these lymphoid organs might be reduced by the Roentgen rays and their shrinkage be accompanied by proper drainage of the crypts with resultant clearing up of the infection.

In a series of 46 cases of chronic hypertrophic tonsillitis, reported by Murphy, Witherbee, Craig and others, all but 4 showed a distinct shrinkage of the tonsil two weeks after exposure.

This treatment opens up a new line of thought and may be the means of supplanting surgical measures of enucleating diseased tonsils, without the disadvantage of shock, hemorrhage and an anesthetic.

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[1] Murphy, Witherbee, Craig, Hussey, and Strum: Jour. of the Am. Med. Assn., Jan. 22, 1921.

Technic of Treatment.—The factors governing the dose of Roentgen ray given to the region of each tonsil were as follows: The spark gap, measured between points, was 8 inches; 5 milliampers; 10 inches distance from the target to the highest point of skin exposed. The time of exposure varied from three to seven minutes, according to the age of the patient. The ray was filtered through 3 millimeters of aluminum. The approximate value of this dose was from 1 to 1¾ skin units. The patient to be treated was placed on a table in such a position that the ray entered under the angle of the jaw and penetrated through the soft tissues to the region of the tonsil. The area exposed on each side was about three square inches, the surrounding parts being protected by heavy sheet-lead. For young children a special board was used with retaining straps, and the head secured by means of a gauze bandage.

TUBERCULOSIS OF THE TONSILS.

Schlesinger states (*Forts. der Med. Pediatrics*) that up to the present time the parallelism between advanced tuberculosis of the lungs and tuberculosis of the tonsils, as also that between mild or passed tuberculous processes of the lungs, with the escape of the tonsils, has only been demonstrated in the case of adults, but has not been observed in children. He was able to confirm this parallelism also in children, having found 12 cases of tuberculosis of the tonsils in 13 of florid tuberculosis of the lungs. The diagnosis of tonsillar tuberculosis is hardly possible microscopically, for the reason that tubercular ulcerations are only found very rarely on their surface; neither were the tonsils hypertrophied without exception, but were found pale and firm in nearly two-thirds of the cases. In 9 cases examined for the purpose, the tonsils were found to be affected bilaterally, although not with equal intensity. As to the relation between tuberculosis of the lymphatic glands of the neck and that of the tonsils, in 9 cases the author found that the tonsils were healthy in 2. He inclines, therefore, to the view that a primary tonsillar tuberculosis is not to be taken for granted in all cases; but we must take into account the possibility of their infection by cheesy cervical glands, by means of the return flow of lymph. The author finds some support for this view from the fact that in these cases the recent tubercles are situated at the base of the tonsils away from the crypts.

L. Kingsford[1] examined the tonsils removed post-mortem from 17 children, varying in age from 4 months to 9 years. All showed cervical glandular enlargement, and in 11 it was obviously tuberculous. Of the 17, tonsillar deposits were found in 7, but only 3 exhibited any naked-eye tuberculous changes. Of these 3, 1 showed ulceration, a second scarring, and a third, a sebaceous focus. Practically all the 17 were cases of secondary infection from either blood or sputum. The parts of the tonsils which were the seats of the lesions were usually the lymphoid follicles not far from the epithelial surface, but it is not possible to trace bacilli in from the crypts or surface of the organs. The author believes it possible that infection may work through healthy tonsils to the cervical glands, the former becoming infected at a later period.

Tuberculous tonsillitis is a very rare affection. The tonsils are rarely if ever the site of primary inoculation in pulmonary tuberculosis.

ADENOIDS, ADENOID VEGETATIONS.[2]

Adenoid vegetations consist of an hypertrophy of the adenoid tissue which exists normally in the nasopharynx.

Pathology.—In a less severe form the growth may be confined to the roof of the nasopharyngeal cavity. In severe forms the vegetations are very numerous, irregular in shape, and extend from the roof of the cavity to the lateral walls. They grow from the fossa of Rosenmüller. They frequently cover the orifices of the Eustachian tubes. They are frequently located between the enlarged pharyngeal and faucial tonsils.

Age.—The new-born infant as well as the premature infant frequently has adenoids. As a rule children reaching the fourth or fifth year without adenoids developing, rarely acquire them later in life.

Symptoms.—The "adenoid habitus," the pinched expression of the nose and the long drawn face, are very typical. There is frequently lateral narrowing of the alveolar arch and prominence of the upper incisor teeth. Owing to the interference of respiration the mouth is kept open. The lips are swollen and thick.

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[1] The Lancet, January 9, 1904.

[2] For Congenital Adenoids, see clinical history on page 223.

The disorders arising from the presence of adenoids are: Repeated attacks of coryza, chronic rhinitis, arrest of nasal development, nasal stenosis, and mouth breathing, with the associated mental listlessness. There is a tendency to bronchitis, to spasmodic croup and asthma. Children with adenoids usually have very poor appetites. There is an associated gastric catarrh.

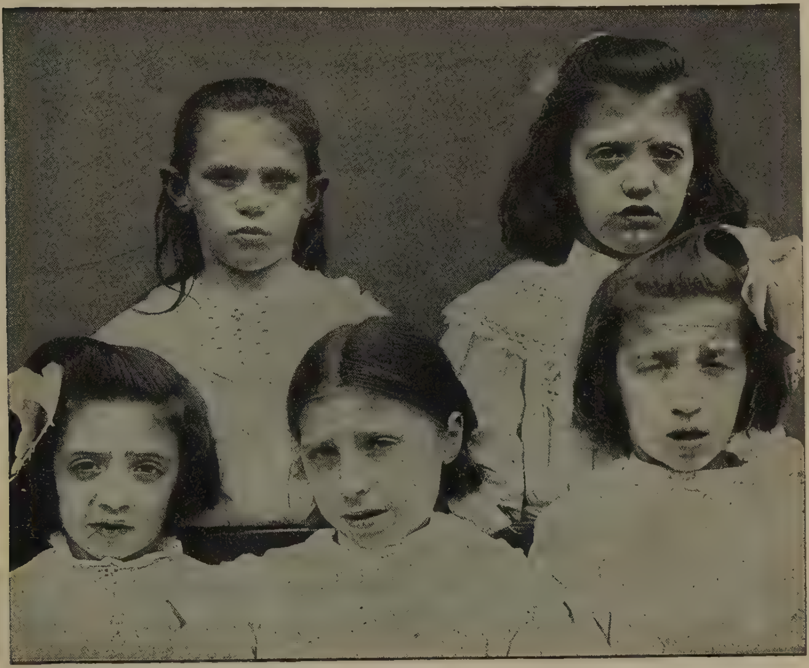

Fig. 119.—Adenoid faces. A group of school children suffering with adenoids. They show the typical nose and mouth expression. Photograph received through the courtesy of the Health Department, New York City.

Some authors state that measles, scarlet fever, and ear troubles are more frequently found in children where adenoids exist. Their presence is therefore a menace and they certainly invite infection.

Spicer has directed attention to the distention of the transverse nasal veins as one of the indications of the presence of adenoids.

Deafness.—Deafness is frequently caused by the presence of adenoids. The amount of interference caused by the adenoids will depend on the relation of the Eustachian tube orifice to the vault of the pharynx. If the orifice be situated high up, a small amount of growth will occlude it and cause auditory trouble. When the orifice is situated low down there may be extensive vegetations without the Eustachian tube being implicated. The voice has a muffled sound with a nasal twang. The letters m, n, and ng cannot be pronounced. Stuttering or stammering can frequently be cured if vegetations are removed; the explanation being that the spasmodic actions of the muscles of the throat are due to reflex irritation. Earache frequently accompanies adenoids.

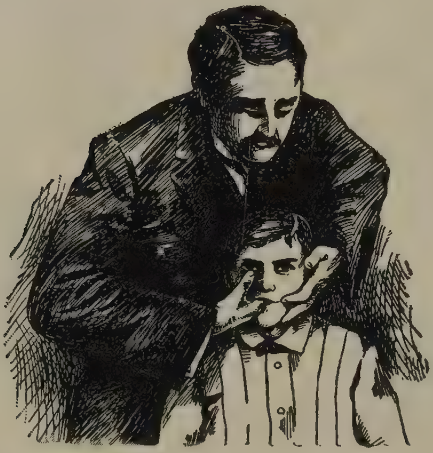

Fig. 120.—Digital method of exploring the rhino-pharynx for adenoids.

Bed wetting is usually associated with adenoids. Among several hundred children examined in the children's service of a large dispensary, it was rare to find a case of enuresis that was not associated with adenoid vegetation.

Diagnosis.—The mouth breathing, the snoring at night, the adenoid face, are in themselves sufficient to establish a diagnosis. *To examine the rhino-pharynx for the presence of adenoids,* have the nurse seated with the child on her lap, firmly pinning the child's feet between her knees. While the right hand confines the child's arms, the left hand is used to support the head. The physician should then separate the jaws with the aid of a mouth gag and explore the post-nasal space with his index finger. In the absence of a gag a clean cork or the handle of a spoon protected by gauze can be used to separate the jaws.

The physician can best make the examination by standing directly behind the child.

If the child is very unruly it is wiser to pin a sheet securely across the arms and examine in the dorsal position.

Differential Diagnosis.—In making a diagnosis of adenoids in infants we must depend upon the inability to nurse properly and noisy mouth breathing. However, many other cases of noisy mouth breathing should be excluded. These briefly mentioned are:—

1. Congenital, as:—
    - Diminution in size or occlusion of one or both nostrils.
    - Highly arched palate or deformity of soft palate.
    - Distortion of cervical vertebræ.
    - Atelectasis.

2. Constitutional, as:—
    - Syphilis.
    - Lymphatism.
    - Tuberculosis.
    - Lithemia.

3. Other conditions, such as:—
    - Acute rhinitis.
    - Retropharyngeal abscess.
    - Disturbances of digestion.
    - Paralysis of soft palate or pharynx.
    - Diphtheria, especially nasal.

These have to be carefully considered. These conditions may exist with adenoids, but when alone may cause symptoms similar to those occasioned by the presence of the hypertrophied tissue, so an operation may not result in the promised cure. In infants the examining finger, on account of its size, is out of the question, and the rhinoscopic mirror cannot be employed. To be absolutely certain the curette must establish the diagnosis.

Treatment.—It is best to use an *anesthetic*, as most children with adenoids are of a neurotic temperament. Be sure the child has neither heart nor kidney trouble before deciding upon an anesthetic. If either condition exists, operate without an anesthetic.

A rapid anesthetic in children is chloroform. To be safe I advise the use of nitrous oxide followed by ether as the best means of producing anesthesia. Deep anesthesia is uncalled for, as in that condition the cough reflex would be abolished. It is better to do the operation completely rather than put a child to the pain and discomfort of repeated sittings. Two or more sittings may be necessary if the child is not anesthetized. The evening before the operation a 1-grain dose of calomel or a wine-glass of citrate of magnesia has a beneficial effect on the bowels. The position of the child during the operation is of great importance. Some operators prefer the head over the end of the table. Butlin[1] says the patient should lie on the side with the thighs flexed, the head a little forward on a low pillow.

The Operation.—The Gottstein curette or its modification is best adapted to work in the antero-posterior diameter of the nasopharynx. The Lowenberg forceps or its modification is used to grasp the mass and is preferred by many operators.

With the curette the portion removed is apt to be lost and might even drop into the larynx, although it is the safest instrument to use with very young children. The best type of forceps is the Graedle or its modification by Concannon. This forceps has an extensive cutting edge, hence tearing is unnecessary.

Operating Without an Anesthetic.—The child should be placed in an upright position and held by an assistant. A mouth gag is used, and the closed forceps is introduced. The forceps is then opened widely and pressed well upward and behind. The mass is seized and the forceps withdrawn. The finger should always be introduced to be sure of the location and extent of any remaining masses. The latter can be removed with the finger, curette, or with smaller forceps.

If the Gottstein curette is used it should be carried well up into the vault, carrying the soft palate forward; then it should be brought down with a bold sweep, to the vault of the pharynx. The steel nail is frequently advised by some operators as a means of removing adenoids. In spite of the most careful treatment adenoids will frequently recur.

Hemorrhages after Operation.—The local application of diluted peroxide of hydrogen, or Monsell's solution undiluted, is sufficient to control any ordinary hemorrhage. If, however, it is a case of hemophilia or profuse bleeding, then the subcutaneous injection of 30 cubic centimeters of sterile horse serum into the thigh or abdomen will control the bleeding.

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[1] Lancet, vol. i, p. 363.

Thromboplastine, obtainable at the Research Laboratory of the New York Board of Health, has recently been recommended by Hess. It is markedly hemostatic and somewhat antiseptic in action, and should be applied locally for a few minutes to the bleeding surface by means of cotton or gauze. If applications do not stop the bleeding, inject some of the clear solution into the site of the hemorrhage.

For gastric or intestinal hemorrhage, the contents of 1 vial (20 cubic centimeters) should be diluted with 8 ounces of water and taken by mouth. This may be given several times in the course of the day. Plugging the nostril with gauze saturated with thromboplastine is very efficacious in hemorrhage caused by exfoliation of diphtheritic membrane. This has been used by me at the Willard Parker Hospital with excellent results.

Treatment of Adenoids after the Operation.—As some blood will be swallowed during the operation it is advisable to order 2 drams of castor oil two hours after the operation, and two hours later 2 drams of milk of magnesia. This will cleanse the gastro-intestinal tract, also have a soothing effect on the mucous membrane of the throat. Ice cream is relished by children for its cooling effect and it also gives some nutrition.

If the child is old enough, a gargle of diluted Dobell's solution several times a day is indicated. If the child cannot gargle then several drops can be put into the nostrils with the aid of a dropper, several times a day.

Codliver oil and malt extracts are among the restoratives indicated for the after-treatment. The most important part of the after-treatment consists in the strict application of hygienic measures. The child should be placed in a room in which there is fresh air, windows open night and day. If a child is old enough we should teach it how to breathe. Out-of-door exercise should be insisted upon. Deep inspiration and expiration, and pulmonary gymnastics are just as important as attention to the food. Milk, meat, eggs, cereals, and fruits should be ordered, depending on the age and requirements of the case.

PHARYNGITIS.

The proximity of the pharynx to the tonsils renders this portion of the body very prone to harbor pathogenic bacteria. Infections therefore spread from the tonsils to the pharynx or from the uvula to the pharynx. In the article on tonsillitis I refer to this region as an avenue for infection through which tubercle bacilli may enter the lymph channels and set up a posterior basic meningitis. The diplococcus intracellularis can also enter the pharynx and by this channel set up a cerebrospinal meningitis. The pharynx is therefore an important part of the body to be inspected when obscure febrile conditions exist.

Treatment.—Local applications of dilute Lugol's solution applied to the retropharynx once only by means of a cotton swab, and a spray of Dobell's solution after feeding and at night before retiring is a good means of destroying pathogenic bacteria in influenza or in catarrhal infections. During an epidemic it is good to employ the Dobell spray as a prophylactic.

RETROPHARYNGEAL ABSCESS (RETROPHARYNGEAL LYMPH ADENITIS).

This condition may be due to mechanical irritation or to direct infection. The most common forms met with in children are evidently due to:—

1. Local infection.

2. Abscess caused by a tubercular infection or where caries of the cervical vertebræ exists. This latter condition we meet in older children. It is usually a sequel to the specific infections, and may follow scarlet fever, measles, or diphtheria. It is most frequently associated with influenza and tuberculosis. Rachitic and syphilitic children are predisposed to this disease. Catarrhal affections of the upper air passages also invite this disease.

Pathology.—The retropharyngeal lymph nodes are described (Simon) as forming a chain on each side of the median line between the pharyngeal and prevertebral muscles; these undergo atrophy after the third year. Sometimes adenoids will cause a swelling of the glands, giving rise to fever, but they will not suppurate. At other times the swelling of the retropharyngeal lymph nodes will be associated with external cervical adenitis. It is important to recognize this condition owing to the serious nature of the disease.

Symptoms.—This affection usually develops very suddenly; the infant will refuse the breast or have trouble in swallowing. The food is most commonly regurgitated through the nose. Such infants will have labored mouth breathing. The head is thrown back, there is severe dyspnea, occasionally asphyxia—laryngeal stenosis due to pressure of the abscess on the larynx, interfering with respiration. There is a peculiar snoring sound. With the index finger in the throat the soft fluctuating mass can be felt. On examining the throat with a good light the bulging of the pharyngeal wall will be noticed.

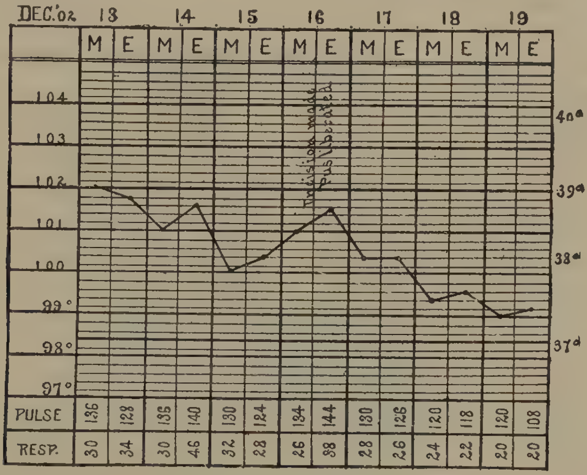

Fig. 121.—Temperature chart from a case of retropharyngeal abscess.

The temperature will range between 102° and 103° F., sometimes higher.

Diagnosis.—The diagnosis should be made with the finger, by a careful palpation of the post-nasal and pharyngeal spaces. Mouth breathing due to adenoids will not cause sudden symptoms of suffocation. The suddenness of interference with respiration points to the development of an abscess. The following cases will illustrate this condition:—

Case I.—An infant about 15 months old had a history of loss of appetite, regurgitating of food through the nostrils, mouth breathing, and bulging of the pharyngeal wall. Temperature, 101° F. Cervical glands enlarged. The diagnosis of retropharyngeal abscess was made. An incision made in the abscess liberated the pus. The abscess cavity was cleansed with a 1 to 2000 bichloride solution. The child recovered.

Case II.—A nursing infant, less than 1 year old, suffered with retropharyngeal abscess. The treatment consisted in hot fomentations. When fluctuation was detected, an incision was made with a curved bistoury; the lower half of the blade was protected with cotton. After the incision the wound was enlarged by introducing and separating the blades of a polypus forceps. The child recovered.

Treatment.—No time should be lost if pus is present. Warm fomentations applied externally, consisting of flaxseed, oil and hot water spread between cheesecloth and changed hourly will hasten suppuration. Spraying the throat with 50 per cent. Dobell's solution several times a day will cleanse discharge. If fluctuation is felt an incision should be made. An anesthetic may be required. Local anesthesia with 5 per cent. novocaine is excellent. The abscess cavity should be opened and the pus liberated. To prevent the pus flowing into the trachea, it is best to keep the head well forward. The use of a gag is not necessary if the tongue is depressed and the incision made with a small-bladed knife similar to a tenotome. After the pus is evacuated the parts should be cleansed with a 1 per cent. carbolic solution or a 1 to 2000 bichloride solution, and the wound treated on general aseptic principles. Restorative treatment will consist in giving codliver oil, wholesome food and fresh air.

SPASMODIC LARYNGITIS (CATARRHAL CROUP: SPASMODIC CROUP).

This form of acute catarrhal spasm was first described by Goodhart. The disease is simply an acute catarrhal inflammation associated with a severe spasm of the larynx. Infants under six months of age are rarely affected, and until 5 years the disease is most common. It occurs as frequently in well-nourished as in frail rachitic children.

Catarrhal or spasmodic croup is frequently the result of hypersecretion in the nasopharynx. When *croup appears suddenly it should not be feared,* especially so if the child was well during the day. It simply results from post-nasal secretions accumulating while the child lies on its back. Such croupous attacks will always yield to a good emetic dose of syrup of ipecac. Such children while awake suffer from the irritation of the secretion and swallow the same by day. A point to remember in this connection is that croup which is fatal or serious comes on *very slowly* and cannot be permanently benefited by giving an emetic.

Symptoms.—The symptoms are similar to those of laryngeal diphtheria. It is at times *very difficult to differentiate catarrhal spasm of the larynx from diphtheritic croup.* It is frequently found in infants with adenoid vegetations and post-nasal catarrh. An inflamed uvula, diseased tonsils, and pharyngeal catarrh are among the contributing factors. The mucous membrane is red and swollen. At first it is dry, but afterward it is covered with a watery mucous secretion. The catarrh may begin in the subglottic portion of the larynx and may be associated with edema of the mucous membrane. It usually follows catarrh of the nose and pharynx, or it may be an extension of the disease from the bronchi.

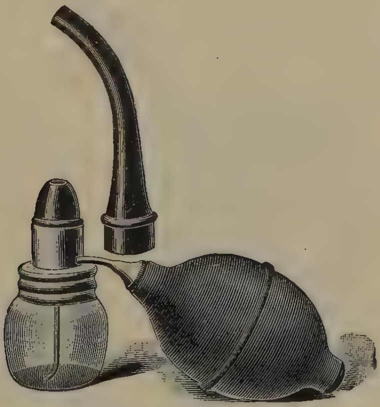

Fig. 122.—Oil atomizer.

Children suffering from this form of croup will usually have repeated attacks of the same. The slightest exposure to cold and irritation by dust are among the exciting causes.

After an attack of rhinitis lasting one or more days, the child will suddenly awaken at night with a hoarse, barking cough and the face will be extremely congested. The attack terminates by a long, noisy, high-pitched inspiration.

On inspiration we note deep recession of the suprasternal fossa, the supraclavicular spaces, and the epigastrium. There is also depression of the intercostal spaces and the walls of the chest. The pulse-rate will be greatly accelerated. The temperature rarely rises over 102° F., although in some instances it may reach 103° F. Owing to the dyspnea, children will usually gasp and try to sit up. The forehead and sometimes the whole body will be covered with large beads of perspiration after an attack of laryngeal spasm.

Prognosis.—This is invariably good. A point to remember is that when *croup appears suddenly,* it is of a mild type resulting from catarrhal trouble. *The dangerous form of croup comes on very slowly,* and in this type we must always look for diphtheria as a causative factor.

Treatment.—In the treatment of diseases affecting the air passages we aim, roughly speaking, at two things:—

First.—To relieve the cough.

Second.—To cure the disease.

LOCAL TREATMENT.

℞ Table salt	1 dram.
Warm water	1 pint.

Or:—

℞ Bicarb. of soda	1 dram.
Warm water	1 pint.

Or:—

℞ Tr. ferri chloridi	1 dram.
Glycerine	1 ounce.
Water	1 ounce.

Or:—

℞ Menthol	5 parts.
Alboline	100 parts.

Or:—

℞ Menthol	5 parts.
Paroleine	100 parts.

Either of the above solutions can be used in the form of a spray every two or three hours. This lubrication soothes the mucous membrane. Guaiacol, 2 per cent. solution, dissolved in alboline, can also be used.

℞ Balsam of Peru	½ dram.
Oil of eucalyptus	½ dram.

M. Sig.: Dissolve in 2 drams of alcohol. A teaspoonful into a pint of boiling water, to be used in the form of a spray, by means of a steam atomizer, or croup kettle. (Fig. 122.)

Local applications of iodine and glycerine are frequently valuable:—

℞ Iodine	3 grains.
Glycerine	1 ounce.
Kali iodide	5 grains.

M. Sig.: Apply with a cotton swab, on larynx. Once daily.

When this catarrh persists, a single application of the following will frequently abort an acute attack:—

℞ Argenti nitrici	10 grains.
Aquæ destillatæ	1 ounce.

M. Sig.: Apply cautiously over the larynx.

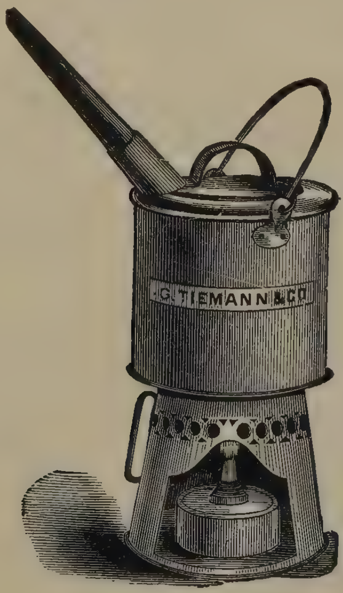

Fig. 123.—Croup kettle.

Emetics.—The most rapid method of relieving catarrhal accumulations is giving an emetic. The choice of the same depends on individual experience. A safe and harmless emetic, quite rapid in action, is a teaspoonful of syrup of ipecac. The same dose may be repeated in half an hour if not effectual. Syr. scillæ comp., commonly known as Cox's hive syrup, in teaspoonful doses, is also a mild drug, producing emesis. Mustard water and sulphate of zinc are also useful. Tartar emetic in 1/10-grain doses, gradually increased, is valuable. My favorite emetic is sulphate of copper, 1-grain dose, with 1/2 ounce or less of water. This usually produces an instantaneous effect.

When children are obstinate and will not swallow, a $\frac{1}{50}$-grain or $\frac{1}{25}$-grain tablet of apomorphia, given hypodermically, may be repeated in ten or fifteen minutes if necessary. This is a convenient and rapid means of producing emesis. Emesis should not be repeated oftener than once in twenty-four hours, and then always with due regard to the condition of the child.

Inhalations of steam impregnated with turpentine or pine-needle oil have served me very well. For producing this steam a croup kettle or a steam atomizer may be used.

The steam loosens the viscid secretion and can be used every hour or less often, depending on the urgency of the case.

FOREIGN BODIES IN THE LARYNX.

Foreign bodies such as fish bones or particles of food are occasionally aspirated into the larynx, causing coughing and irritation. In some cases laryngeal stenosis and symptoms of asphyxia result. No time should be lost in commencing treatment, owing to the danger of suffocation.

The hypodermic injection of apomorphia ($\frac{1}{50}$ grain) until emesis is produced, or syrup of ipecac, several teaspoonfuls given by mouth, will occasionally dislodge the foreign body. If this is not successful a laryngologist should be sent for. A physician who is inexperienced with the larynx should refrain from prolonged attempts to dislodge the foreign body, as in most cases only harm can result therefrom. If asphyxia threatens, tracheotomy should be performed. Those experienced with intubation should first try the effects of the large caliber tube known as the foreign-body tube (see chapter on Intubation).

COUGHS OF REFLEX ORIGIN.

Night Cough.

A very troublesome form of cough is frequently heard at night. The history given is that the child is quite well during the day, but has a distressing cough at night.

The position of the child on its back permits nasopharyngeal accumulations to stagnate; hence, this cough occurs when the child is on its back. Very young children do not expectorate, nor can they clean the nose.

Diagnosis.—A history of cough at night only points to nasopharyngeal disease. As a rule adenoids and chronic tonsillitis or pharyngitis should be suspected. The absence of fever and the freedom from cough during the day indicate a local catarrh which gravitates when the child is on its back.

Treatment.—If adenoids are present they should be removed. Nasopharyngeal catarrh should be treated by local applications of ½ per cent. of iodine and glycerine solution. The nasopharynx should be washed by means of a douche every morning and evening. A weak solution of boracic acid or bicarbonate of soda is very serviceable. In persistent catarrh codliver oil should be given.

Spasmodic Cough (Pseudo-pertussis).

I have previously described a cough which occurs in children having catarrh of the upper air passages; sometimes this night cough is paroxysmal in character and the spasm resembles whooping-cough.

Cause.—The accumulation of the mucus in the region of the arytenoids and the vocal cords sets up a spasm of the glottis, resulting in attacks of suffocation.

One of the most frequent causes of spasmodic cough is edema of the lingual tonsil, and its treatment will frequently relieve this condition.

Symptoms.—A hoarse or barking cough, appearing in spasms with an interval of rest, is usually heard. The cough is frequently followed by vomiting. The temperature is rarely above normal.

Diagnosis.—The absence of the cough by day and the appearance of the cough in spasms when the infant is placed on its back always point to a local throat condition of a non-inflammatory character.

Treatment.—Orthoform insufflated into the retropharynx is soothing and should be used at least three times a day. In older children orthoform troches dissolved on the tongue every half hour will relieve the cough. When coughing persists despite local treatment a change of air should be advised. Restorative treatment, consisting of iron and Fowler's solution, will sometimes permanently benefit the child.

Reflex Cough.

In post-nasal catarrh we frequently have a profuse discharge which, by irritating the pharynx, causes a cough. This cough frequently resembles that of an acute bronchitis. The examination of the lungs in such cases is usually negative. It is therefore advisable to examine the nose and throat in every case of cough.

II.

DISEASES OF THE BRONCHI.

THE lungs in children occupy the same position as in adult life. The trachea of the young child is larger in comparison than in the adult; so also the bronchi are larger than in the adult. They occupy more space and are more numerous than in the adult, but the air-cells are much smaller. I have described in detail the method of examination of the thorax in the article on The Respiration in the New-born Baby.

The diaphragm occupies a higher position in children than in adults. Dwight studied a series of frozen sections and found the diaphragm in the infant corresponding to the eighth and ninth dorsal vertebræ.

POINTS TO BE NOTED IN THE DIAGNOSIS OF DISEASES OF THE LUNGS.

Auscultation.

Acute catarrhal bronchitis: Sibilant and sonorous râles. Large and small bubbling râles.

Capillary bronchitis: Sibilant, subcrepitant râles.

Asthma: Sibilant, wheezing, sonorous breathing.

Emphysema: Respirations diminished, absent, or prolonged; low-pitched expiration.

Edema: Bilateral subcrepitant râles.

Pneumonia: (1) Crepitant râles; (2) bronchial breathing and bronchophony; (3) broncho-vesicular breathing, crepitant, subcrepitant, and bubbling râles.

Pleurisy: Friction sound with each respiratory act, best heard with inspiration. If the child controls the movements of the lung and keeps the pleural surfaces apart, then no friction sound is heard.

Subacute pleurisy: Friction, absence of vesicular murmur, and vocal resonance.

Fluid and air in pleural sac: Respiratory murmur absent, amphoric breathing above, all sound absent below, splashing râles.

Tuberculosis: Long, high-pitched expiration, breathing feeble, vocal resonance increased, adventitious râles, later bronchial breathing, bronchophony.

Tuberculosis, second stage: Cavernous breathing, amphoric breathing, gurgles, metallic echo.

Percussion Resonance.

Vesicular: Uncomplicated lung.
Dullness: Lung with increased proportion of solids.
Flatness: Solids, fluids.
Tympanitic: Large body of air.
Vesiculo-tympanitic: Lung with increased proportion of air.
Amphoric: Empty cavity with tense walls.
Cracked-pot: Cavity with flaccid walls.

Rhythm.

Normal rhythm: Regular succession of the respiratory acts.
Interrupted rhythm: Slight deposit in lung.
Divided rhythm: Want of elasticity in lung.
Prolonged expiration: Want of elasticity in lung.

Breathing.

Vesicular: Uncomplicated lung.
Bronchial: Consolidated lung; compressed lung.
Broncho-vesicular: Moderate consolidation, moderate compression.
Cavernous: Flaccid cavity-walls.
Amphoric: Tense cavity-walls.
Exaggerated: Vicarious respiration.
Diminished: Plastic exudation, want of elasticity.
Absent: Fluid, air.

Vocal Resonance.

Normal: Voice through normal chest.
Bronchophony: Voice through consolidation.
Amphoric: Voice in a cavity.
Ægophony: Voice in compressed lung.
Pectoriloquy: Articulate voice in cavity; in consolidation.
Whispering pectoriloquy: Whispered articulation in cavity; in consolidation.
Cavernous whisper: Ill-defined articulation in cavity.

BRONCHITIS (BRONCHIAL CATARRH; ACUTE BRONCHITIS).

Bronchitis, commonly known as bronchial catarrh, is one of the most frequent diseases of infancy and childhood. It frequently follows nasal catarrh, pharyngeal catarrh, or catarrh extending from the trachea.

Etiology.—There are certain predisposing factors which favor the development of this disease. Children with deficient nutrition, suffering with anemia, and those with a weakened framework having rickets, are more susceptible to this disease. Children affected with catarrh of the upper air passages frequently invite an extension of this inflammatory process.

Bacteriology.—The pathogenic bacteria found in the bronchi are staphylococci, streptococci, colon bacilli, and diphtheria bacilli. The bacteria most frequently seen are the diplococci of pneumonia and streptococci; in addition to these the bacillus of influenza frequently gives rise to bronchitis. Other germs found are bacillus pyocyaneus and encapsulated bacilli. Ritchie[1] states that the above micro-organisms are rarely found alone, but always associated. He does not believe that a definite germ is the causative agent. These same micro-organisms under different conditions frequently enter the alveoli and produce pneumonia.

Pathology.—The anatomical changes noted in bronchitis are the same, irrespective of the cause. The disease may be limited to the large bronchial tubes or may extend into the finest ramifications. This tendency to extend into the capillaries is great in children and still more so in infants. The accumulation of the catarrhal products in the smaller tubes adds a gravity of its own to the situation. It is well to emphasize this peculiar tendency of the trouble in those of tender age.[2]

On making a cross-section of the lung a muco-purulent discharge oozes from the bronchi. The same thick purulent matter can be forced out of the smaller tubes when compressing the lung between the fingers. The microscopic examination shows intense congestion of the superficial blood-vessels. Frequently there is a serous infiltration of the bronchial mucous membrane.

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[1] RITCHIE: Journal of Pathology and Bacteriology, 1900, vii, 1-21.

[2] CHRISTOPHER: Article on Bronchitis, American Text-book on Diseases of Children.

When the infection extends into the smallest bronchi it is called "capillary bronchitis." Williams calls it "suffocative," owing to the severe symptoms which develop.

Capillary bronchitis is always accompanied by some alveolar catarrh and frequently passes on to a distinct broncho-pneumonia. Infectious secretions in the larger bronchi are sometimes sucked into the smaller bronchi and frequently cause an inflammation of the lobule. A plug of mucus frequently acts as a valve in a bronchus, permitting some air to escape during expiration and preventing the entrance of air during inspiration.

When all the air is expelled the lobule may collapse. This condition is known as atelectasis pulmonum. This condition is favored when the thorough expansion of the air tubes is interfered with. It is also favored by congestion, thickening of the mucous membrane, and the gummy secretions produced by bronchitis.

It, moreover, accompanies those cases in which the position is not frequently changed. It is seen in rachitic deformities of the thorax. The most frequent place for this condition is at the border of the lungs. The collapsed area is of a dark-red or purple color and shows a uniform red surface on section. It sinks in water, but can be insufflated unless inflammation has already begun. (Williams).

Rachford has shown that disease of the lymphatic system is a factor in producing malnutrition in children. In children having the latter condition we must not be surprised if we have a persistent bronchial catarrh baffling the ordinary method of treatment.

Symptoms and Diagnosis.—The symptoms vary with the severity of the disease. In mild cases the temperature rises to about 101° F. at night; in severer cases the temperature will reach 102° and even 103° F. The respirations are quickened and labored and the pulse is accelerated. When the temperature is subnormal in rachitic children, then such low temperature should be looked upon as a grave symptom. On auscultation sibilant râles are heard anteriorly, but are more prominent posteriorly.

As the secretion from the mucous membrane begins, the sibili give place to loose mucous râles. Graves's point is worth noting: That the more numerous the sounds heard at any one point to which the stethoscope is applied, the smaller the bronchi involved.

Much stress should not be laid on the sputum or the character of the expectoration. Children under 5 years rarely or never expectorate. The pulmonic resonance is usually normal. If the attack is a mild one, as the above-named symptoms would seem to indicate, then the symptoms will subside under palliative treatment. The greatest attention should be bestowed on the pulse.

A pulse-rate between 120 and 130 in a young child should be looked upon favorably. If the pulse is suddenly accelerated and reaches 140 to 160 and the respirations are increased to 60 or 80 per minute, then a bronchopneumonia should be suspected. The *normal ratio of respiration to pulse is about 1 to 4;* when this is disturbed so that the ratio is 1 to 2, or even 1 to 3, we should suspect pneumonia.

Prognosis.—This varies according to the severity of the symptoms and the condition of the infant before it was taken sick. Children having a cachectic condition or those having syphilis will certainly have a severer type of infection than children not so affected. In subnormal conditions bronchitis will frequently leave some traces, so that a chronic bronchitis is established.

Treatment.—*Hygienic Treatment:* A child with bronchitis must be put to bed in a room having a temperature of 68° to 72° F. The air should be kept free from dust. The room must be properly ventilated. The patient should be given as much sunshine as possible. Dark, ill-ventilated rooms will aggravate this condition. The body should be warmly clad—not too warm. Flannels should be worn next to the skin. A lukewarm sponge bath followed by friction with a coarse towel will stimulate the circulation and is soothing to the child. If the child has a high temperature then a mustard foot bath should be ordered.

Dietetic Treatment.—If the child takes a large amount of nourishment and assimilates the same, then the chances of restoring health are excellent. To rely on drugs and exclude food is to discard the most important part of the treatment. When the child refuses food by mouth, then rectal feeding should be resorted to, so that the body is sufficiently nourished. It is a good plan to predigest milk for feeble infants; hence peptonized milk or whey and soups and broths should not be forgotten. The yolk of an egg beaten up with sherry wine for a child several years old will be found a convenient method for giving nourishment with stimulation. Water is very important in the treatment of this disease, especially so when there is a large amount of expectoration.

Medicinal Treatment.—If the temperature is over 102° F., 1-drop doses of tincture of aconite, given every two hours, will be useful to reduce the fever. All children who cough swallow their mucus; hence a laxative or an emetic will be very serviceable. A teaspoonful of castor oil, repeated in six hours, is very valuable. As an emetic a teaspoonful of syrup of ipecac, repeated in fifteen or twenty minutes if necessary, can be tried. When rapid emesis is desired, 1 grain of sulphate of copper dissolved in a teaspoonful of water will be very effective. This dose should not be repeated more than once in two or three hours. Apomorphin in doses of $1/10$ grain, hypodermically, is a very effective emetic. This is indicated when the child refuses to take medicine.

When the secretion is very viscid then steam inhalations will be very serviceable. The steam atomizer will be found very valuable in young children who cannot be held over moist vapor. Steam impregnated with beechwood creosote will be found a valuable means of loosening adherent mucus. It has a decided therapeutic effect. It is a powerful antiseptic.

Restorative Treatment.—Restorative treatment, such as using an emulsion of codliver oil or a malt extract, with or without iron, should not be omitted.

ASTHMATIC BRONCHITIS.

In acute or subacute asthmatic attacks with marked wheezing there is usually cyanosis and a livid expression of the face, intense dyspnea, and a very anxious expression. The temperature is slightly elevated rarely reaching 101° or 102° F. Such asthmatic attacks induced by protein anaphylaxis will recur until the body is desensitized. Immediate relief can be given by hypodermic injection of 5 to 10 drops of adrenaline chloride solution of 1 to 1000 strength. In children below the age of three years 3 drops of the adrenaline solution is sufficient. A marked disturbance of the circulatory system usually follows the injection but the effect on the asthma is almost specific.

ASTHMA.

We are indebted to Richet who found that the first dose of a protein given to an animal, was followed by a condition of markedly greater suceptibility to that protein. This phenomenon is called anaphylaxis: The animal is sensitized by the first dose of protein and is shocked by a properly spaced dose of that protein. The anaphylactic shock is due to the meeting of a specific antigen (the second dose of protein) with its antibody (produced by the first dose) and the resulting reaction gives rise to a product which causes the characteristic symptoms. Anaphylaxis therefore consists simply in the cellular reaction due to the fixation of antigen by cellular antibody. In true bronchial asthma we now know that the patient is previously sensitized to some protein but we do not know why, and furthermore we do not know whether it is the whole protein itself, or the toxic product which is produced when the protein meets its antibody, or a toxic split product of the protein (Vaughn)[1] that irritates the nerves innervating the bronchi. Further discussion on this point at present would be endless and futile, but it is certain that the causative agents in the production of an attack of true bronchial asthma concerns a protein.

Asthma in infants and very young children frequently presents at first a condition of frequent colds or bronchitis, even though the cause is anaphylactic in nature and not due to bacterial infection. This is probably so because the infant's bronchial mucous membrane and respiratory mechanism is easily irritated (a protective mechanism which is not necessary after intelligence is more fully developed), and more probably so because asthma in infants and very young children is usually caused by foods which are so frequently eaten that the condition is chronic from the beginning. Furthermore, since such a young individual spends most of its time sleeping by itself, especially after eating, it is possible that he could have true attacks of bronchial asthma from food proteins for some time, long enough to produce a constant bronchitis, before the immediate family might recognize any ailment. An adult, who has bronchial asthma from food proteins, rarely if ever vomits as a result of eating those proteins, but infants and young children frequently vomit following the ingestion of some protein which, if persistently eaten or not eaten for a long time, later on causes typical bronchial asthma. The act of vomiting in these cases is evidently another illustration of protective mechanism, since Schloss and Worthen[1] have found that the gastroenteric tract of infants is permeable to undigested foods. Further discussion of the clinical symptoms associated with the two types of bronchial asthma will be considered more specifically later on.

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[1] VAUGHAN, V. C.: Jour. Am. Med. Assn., 1916, lxvii, 1.

Protein Sensitivity.—There are several methods of determining whether a patient is sensitive to a protein or not. One way which is used more or less is the intradermal or intracutaneous injection of the protein; there are, however, some objections to this method and it tends to be too delicate if not non-specific. A test which is used more extensively and which is very reliable is the cutaneous or skin test, which is performed in the following manner. A number of small cuts, each about an eighth of an inch long, are made on the flexor surfaces of the forearm. These cuts are made with a sharp scalpel, but are not deep enough to draw blood, although they do penetrate the skin. On each cut is placed a protein and to it is added a drop of tenth normal sodium hydroxid solution to dissolve the protein and to permit of its rapid absorption. At the end of a half-hour the proteins are washed off and the reactions are noted, always comparing the inoculated cuts with normal controls on which no protein was placed. A positive reaction consists of a raised white elevation or urticarial wheal surrounding the cut. The smallest reaction we can call positive must measure 0.5 centimeter in diameter. All larger reactions are noted by a series of plus marks and any smaller reaction is called doubtful. As evidence that the skin test is satisfactory and conservative, we have found by treatment with subcutaneous injections of proteins that we cannot inject a patient with a stronger solution of a protein than that which gave a positive reaction without provoking an attack of asthma; and that a series of treatments with weaker solutions, which failed to give a positive skin test, produces no benefit.

The cutaneous or skin test, therefore, separates true or typical bronchial asthma from the atypical or asthmatic bronchitis. The patient with the typical variety gives a positive skin test with proteins and is therefore sensitive to those proteins which are the direct cause of the asthma, whereas the atypical variety fails to give a positive skin test with proteins, thereby excluding proteins as a direct cause of asthma. Rarely one will test a patient who reacts positively to every protein tried but the normal control will also be positive, so that such positive reactions must be discontinued. False positive reactions in such patients that react to all skin cuts are due to temporary irritability of the skin, since at another visit, later on, the skin tests may be done satisfactorily. Fortunately such cases are rarely encountered. Frequently patients give a positive skin test with one or more proteins that have no bearing on the cause of the asthmatic condition, but these proteins are the cause of eczema, or urticaria. Proteins recommended for the routine test: Horsehair or dander; cat hair; feathers; the pollens of timothy, redtop, and ragweed; staphylococcus pyogenes aureus and albus; streptococcus hemolyticus and viridans; pneumococcus Types I, II, and III, and diphtheroid bacilli; the common foods such as egg, milk, cereals, meats, chicken, potatoes, and any other that the patient is accustomed to eat frequently.

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[1] Schloss, O. M. and Worthen, T. W.: Am. Jour. Dis. of Child., 1916, xi, 342.

Occasionally the patient's history or surroundings may lead one to suspect some other common or even unusual type of protein; such instances will be mentioned later on.

Entry into Body of Proteins Causing Asthma.—The sources through which proteins that cause bronchial asthma enter the body are inhalation, absorption, and infection. Inhalation takes place through the respiratory tract and chiefly concerns the proteins in the pollen of plants, in the emanations and the hair of animals, in the flour of cereal grains, and in organic dust. Ingestion has to do with the protein in food, and we know that foods, after entrance into the gastrointestinal tract, do cause asthma. Absorption, apart from inhalation and ingestion, concerns the conjunctivæ and to a less extent, the skin. By infections we mean the presence of pathogenic bacteria in any part of the body, but more especially foci of infection located in the teeth, tonsils, nose, throat and lungs. In the case of bacteria we have to deal with the protein element as well as with the infectious element. The skin test has to do only with the protein element, so that even though bacteria give a negative test, they may still be a cause of asthma through their infectious nature and the patient need not be sensitized to bacterial protein. Through inhalation the protein acts as an irritant on the peripheral endings of the constrictor nerve fibers; through ingestion and absorption the incompletely digested proteins or the amino-acids, by circulating in the blood stream, probably act upon the central end of the constrictor nerve fibers; and through infection the bacterial protein may act either or both ways.

Bronchial Asthma			
Sensitive to protein.		Not sensitive to protein.	
Asthma throughout the year due to	Seasonal asthma due to	Asthma throughout the year due to	Seasonal asthma due to
animal food bacteria.	pollens.	bacteria.	bacteria.

Sensitization to food proteins is by far the most frequent type of sensibility found in infants. Of 29 patients, 9 were sensitive to egg protein, 8 to the cereal grains, and 3 to milk. Of 9 patients, who began asthma between the ages of 2 and 5 and who were sensitive to food proteins, 2 were sensitive to egg and 5 to cereal grain proteins.

Talbot in a series of 45 children who had bronchial asthma, found the skin test positive with egg in 27, beef in 5, wheat in 6, horse hair in 7. Koessler[1] and Rich[2] and many others report cases of asthma in young children caused by egg. The frequency of sensitization to bacterial proteins was about the same for all ages of onset, and the same was true of pollens up to adult age, after which pollen sensitization was rare.

Treatment.—The treatment of bronchial asthma consists of the following kinds: Preventive, drug, specific protein, vaccine, non-specific protein, operative procedure, climatic and supportive; of these the specific protein and the vaccine treatment are of prime importance. Naturally sensitization cannot be prevented in the human. However, when an infant or child has symptoms of recurrent colds and bronchitis which fail to yield to ordinary medication, that person should be tested for sensitization.

Specific Protein Treatment.—Specific protein treatment, which is the most successful procedure, consists of treating or desensitizing the patient with those proteins to which the individual is found to be sensitive by the skin or cutaneous test. Subcutaneous inoculations with the offending food proteins do desensitize, but the process is a long and tedious one, and this method is less satisfactory than the method of feeding proteins. Schofield[1] was probably the first to overcome sensitization with food proteins by feeding them. He gave his patients pills containing minute amounts of the offending proteins, gradually increasing the dose until large amounts were taken without symptoms. Although it required two years before the patient was able to eat a whole egg, the cure seems to have been permanent. Rich, in the same manner, accomplished similar favorable results in a year's time. The difference in the length of time depends upon the size of the initial amount which the patient can take without symptoms. Schloss[2] and Talbot[3] have had success with this kind of treatment, and Grover has had some success by feeding the food protein in a liquid form.

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[1] Koessler, K. K.: Ill. Med. Jour., 1913, xxiii, 66.

[2] Rich, H. M.: Jour. Mich. State Med. Sci., 1914, xiii, 649.

Absolute omission of the offending protein is entirely satisfactory and not nearly as difficult as might be anticipated. This problem is sufficiently important to warrant considerable detail. Patients who are sensitive to potato usually are able to eat baked potato even though boiled potato causes symptoms. Although raw milk may cause symptoms, boiled milk will not, and cream and butter, both of which practically consist of only the fat in milk, may be taken. Shredded wheat biscuits and thin slices of bread well toasted on both sides may be eaten, even though the patient is sensitive to wheat. The explanation for these variations is that very high temperatures destroy the anaphylactic properties of proteins. Probably the only common food protein which cannot be treated is that of egg, because heat sufficient to destroy its anaphylactic property would render it non-palatable and indigestible. Furthermore not all of the individual proteins that constitute a food cause symptoms in the same person, and some individual proteins which do cause symptoms may not be present in certain food in sufficient amounts to cause symptoms; such examples follow. In rice the only protein present in appreciable amounts is oryzenin (6.5 per cent.); in oat, glutelin represents 8 per cent. of the protein, whereas avenalin and prolamine each represent 1.5 per cent. or less of the protein; in corn, zein is the chief protein (5 per cent.); in whole wheat, gliadin and glutenin each make up 4 per cent., whereas in the embryo wheat, proteose, globulin, and leucosin are present, respectively in 3, 5, and 10 per cent. The importance of doing skin tests with these individual proteins in the cereals is evident, and in the case of rice, if the patient were not sensitive to oryzenin he could probably eat rice without trouble, since the other proteins are present in rice in too small amounts probably to cause trouble. Usually the same patient is not sensitive to all of the cereals, so that if wheat must be omitted other cereals may be substituted. Often patients are able to eat small amounts of the offending protein, whereas large amounts cause symptoms; this fact has been proven to be true by Schloss and Worthen and by Talbot, to both of whom reference has already been made. Schloss and Worthen found the gastrointestinal tract of infants to be permeable to undigested proteins when taken in large amounts. Another added factor is the finding by Maurel[1] that whole wheat bread is not digested and assimilated as well as that made from the intermediate grade of wheat flour bolted to 75 or 85 per cent.; the author's experience in asthma coincides with this view. Since some patients are sensitive to the amino acids, even these may cause symptoms. Therefore, for all of these reasons, and more especially because of the permeability and abnormalities of the intestinal tract and because of the sensitization with amino acids, omission of at least the careful feeding of the offending protein is by far the most reasonable treatment of food asthmatics.

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[1] Schofield, A. T.: Lancet, 1908, i, 716.

[2] Schloss, O. M.: Amer. Jour. Dis. of Child., 1912, iii, 341.

[3] Talbot, F. B.: Boston Med. and Surg. Jour., 1916, clxxv, 191.

BRONCHIAL ASTHMA.

There are two types of asthma met with in children. One of these is anaphylactic the other is due to bacterial infection. In the first type relief can be afforded by proper treatment with proteins. In the bacterial type autogenous vaccines may relieve.

Exciting Causes.—If adenoids, infected tonsils, teeth, sinuses, elongated uvulæ, enlarged bronchial glands and hypertrophic turbinates are the causes of bronchial asthma they should be attended to, to prevent recurring attacks.

Symptoms.—Without warning, a spasm or shortening of breath comes on, most frequently at night. There is usually such oppression and distressed breathing that the child must sit up. Frequently the distress is so great that the child will grasp any object within reach. The shoulders are elevated and the head thrown back so that the accessory muscles of respiration are brought into play. The face assumes an anxious expression, and later becomes cyanotic. The eyes are prominent and the alæ nasi widely dilated. A cold, clammy perspiration is usually present. The respirations are loud and wheezing, and are rarely increased in number. The inspiration is jerky, the expiration prolonged and laborious. There is very little or no thoracic expansion. The pulse is small and rapid. There is no fever, but we frequently have a subnormal temperature when the attack is prolonged. The extremities are frequently cold. After the attack there is exhaustion followed by sleep. An attack may last several hours, sometimes days. Percussion of the chest during the paroxysm shows *hyperresonance*. There may be either diminution or prolongation of the vesicular murmur. The whole chest has sibilant and sonorous râles and wheezing sounds.

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[1] Maurel, E.: Bull. de l'Academie de Med., Paris, 1917, lxxviii, 799.

The diagnosis is easy; we must exclude spasm of the glottis, croup, tracheal stenosis, and neoplasm in the larynx. The absence of fever will easily differentiate this condition from inflammatory respiratory diseases.

Differential Diagnosis.—When bronchitis recurs in children a skin test should be made. Many cases of bronchitis later develop asthma.

These cases show enlarged bronchial glands, dyspnea, irregular fever. The x-ray is of little or no value in children in differentiating asthma from other conditions. Tuberculosis can be easily differentiated from asthma. In no case of bronchitis or asthma should we omit to test for sensitization.

Doris L., 6 years old, premature—born in eighth month of gestation was a difficult feeding case. Her development was slow, her digestion poor. She had recurring attacks of urticaria and erythematous eruptions, also frequent attacks of acidosis with ammoniacal urine, acetone, and diacetic acid.

During the past two years she has had frequent attacks of bronchial asthma. These attacks occurred as often as once a month, sometimes less often. The temperature rarely rose above 101°, excepting in one instance when 104° was reached. The bronchial symptoms were those of wheezing râles scattered over both front and back of chest, occasional dyspnea, and very little expectoration. On percussion there were dull areas at the apex and bases of both lungs. Fluoroscopic examination was negative. The x-ray of the chest showed no evidence of tuberculosis. A protein test gave a three plus reaction to horse dander and a one plus reaction to goose feathers.

On further inquiry it was found that the child sleeps on a horse hair mattress and has these recurring attacks when she is in town. In the summer when out of town and sleeping on a wool mattress there was no asthma.

Treatment consisted in discarding the horse hair mattress and in restorative diet.

The prognosis is usually good, especially so at the time of puberty. After an attack a careful examination of the lungs, the kidneys, the nose, and the throat should be made, and the exciting cause, if possible, should be noted.

Treatment.—Fresh air to thoroughly oxygenate the lungs will afford relief. Do not use steam or heat of any kind. The application of two or three dry cups over the front and also over the back of the chest repeated every six hours will relieve the spasm. Surprising relief will be afforded by washing the colon with ½ teaspoonful of powdered ox gall in 1 pint of water. The latter will not only empty the colon of feces and gas, but will also relieve the mechanical pressure on the diaphragm. The bowels should be kept loose by giving salines. Iodide of sodium in 1- to 5- grain doses should be given at least one month after the acute paroxysmal attacks have subsided. Codein, ⅕ grain for a child 5 years old, repeated every two hours, or Dover's powder, 1- to 2- grain doses, repeated every three hours until relief is afforded, may be given. Chloral hydrate with or without bromide of sodium in doses of 3 to 5 grains once only should be given at night to promote sleep and as an antispasmodic.

Adrenalin.[1]—This, as a rule, clears up a case, or at least gives marked relief, within a few minutes, but, because of its potentiality and the fact that it loses its effect if repeated often, it should be given only during severe attacks or in cases where there is only an occasional attack, say once a year. Adrenalin can be given in doses from 3 to 10 minims, of the 1 to 1000 solution, by hypodermic injection.

Benzyl benzoate.—This is a harmless antispasmodic and in many cases gives very satisfactory results. Unfortunately, it does not relieve in all cases and has the disadvantage of having an unpleasant and lasting taste. In children who are old enough give the drug in capsules containing 2 minims each, four times a day. In the 10 per cent. solution, the dose is ½ teaspoonful four times a day for a child 6 years old. Increased doses do not appear to be more effective, although in one case in which benzyl benzoate afforded absolutely no relief when given in ½ teaspoonful doses, it did relieve in 1 teaspoonful doses, when two weeks later the patient had his next attack. Benzyl benzoate is best given continuously to patients having frequent attacks, but this is not necessary in those having only occasional asthmatic attacks.

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[1] F. Raoul Mason: New York Medical Journal, Sept. 18, 1920.

Atropine.—When given up to the physiological limit it will sometimes be of benefit.

Iodides.—These drugs may sometimes improve the patient's condition, and can be given in the form of syrup of iodide of iron as a general tonic in all cases.

Drugs, such as aspirin, and the bromides, are of doubtful value; nitrite of amyl or nitrite fumes are beneficial in relieving spasmodic breathing during the paroxysm.

Recently the French and British have found that peptone by mouth or by hypodermic injection prevents anaphylaxis, and they have been giving it in doses of 5 grams, three times a day, by mouth.

Auld has reported good results in a certain number of asthma cases by this means. Mason has tried peptone for a few weeks only in his clinic, so that we are unable yet to report any definite results.

His own experience has been that no drug will help in all cases, but usually some one particular drug will help in each case. Of course, all these measures are merely palliative. We can only expect results by investigating the causes of the anaphylaxis and eliminating such causes as are found. This is done as follows:

The patient is placed on a diet of milk (including milk products), yolk of egg, wheat, potatoes, and one vegetable. He is then tested out for each of these proteins, and should one of them be found to be anaphylactic, it is removed from the diet list. It is also advisable to test with various feathers if their proteins are available. The patient is kept on this restricted diet for a week. Should the asthma be entirely due to food proteins, there will at once be marked improvement. The course to follow then is to test out for more foods and add them to the diet one at a time, eliminating, of course, all those giving positive skin reactions or symptoms. The skin reactions are not infallible and for this reason we should supplement each by a clinical test. It is also important to give these foods in a simple form, otherwise there may be a trace of some other substance which might precipitate an asthmatic attack.

Should we get no result after a diet limited to the few foods mentioned previously, we must next try to find some other causative factor. Inspiratory causes should be looked for. Pollens in the city can fairly well be eliminated but emanations may come from so many sources that we may fail to find their origin. It is best to give the patient a cotton pillow and mattress, to remove all skins from floors, such as bear or tiger, and eliminate pets, like canaries, dogs, and cats. The proteins from dog hair, cat hair, horse dander and feathers from chickens should be tested. Obviously we cannot obtain the proteins for all the various animals, therefore, should these measures fail, the best thing to do is to have the child brought to a hospital and removed from the environment of all sources of animal or flower emanations. This will very often clear up the case and confirm the diagnosis.

The next step is to find the cause by a process of elimination. It is well to remember that contact with the offending material, even for a few minutes, will bring about an attack several hours afterward. Pisek reported a case in which the patient was sensitized to chicken feathers and when placed upon a cotton pillow was asthma free. The child had another mild attack afterward, traced to a pillow fight the previous evening. Should all these precautions fail to discover the real cause, we can reasonably assume that we are dealing with a bacterial type. All obvious foci of infection, such as caries and infected tonsils, should be removed. Results are obtained occasionally by this alone. By skin tests it is sometimes possible to isolate the offending organism, in which case a stock vaccine given in gradually increasing doses is administered. Of more value is a culture from the nasopharynx, grown on both agar and bouillon, and a mixture from these used as a vaccine. In case of failure, and as a last resort, either a second vaccine from the nasopharynx or a vaccine grown from the feces may be tried. In the case of pollens, according to the season of the year, and by means of the skin tests, we are also able to isolate the plant for susceptible individuals. These are the only patients who are benefited by changes of climate, sea trips, or seaside resorts with predominating sea breezes.

In the case of food anaphylaxis, it often happens that the patient is sensitized to some widely distributed article of diet, milk for instance, lactalbumen being the most common offender. This can be eliminated by boiling the milk and allowing it to cool, the lactalbumen rising to the surface as thick skin which can be removed. Unfortunately a great many children object to the taste of boiled milk, but it can at least be used for the cooking of their food. Occasionally we have found that dry milk was tolerated in these cases. Yolk of egg rarely brings about any anaphylactic disturbance, while the white is a frequent cause of asthma. Clinical experience has shown that the cereals, when toasted, are less likely to cause anaphylactic changes and can be taken with less harm in this way.

From the most common foods, we can desensitize the patients with small increasing doses of the protein hypodermically. Such preparations are put up in commercial laboratories, as are also a few of the animal emanations and pollens. With such simple food as white of egg we can desensitize the individual by giving a very dilute solution by mouth three times a day and increasing the dose by a minim each time until tolerance is obtained.

During acute attacks, dietary in origin, removing the offending substance by stomach lavage will sometimes afford relief. As time goes on the treatment will probably be considerably simplified, but at present it is chiefly a question of making the patient understand what may cause an attack and when possible, desensitize.

BRONCHOPNEUMONIA (CATARRHAL PNEUMONIA OR LOBULAR PNEUMONIA).

This disease derives its name from the fact that it usually exists as an inflammatory condition affecting small areas of the alveoli of the lung. Contrary to lobar pneumonia, this catarrhal form does not terminate by a distinct crisis. This disease is usually a sequela to or a complication of whooping-cough, measles, diphtheria, or typhoid fever. It is this form which is most dreaded in diphtheria and which rarely ends favorably. It does not occur in distinct cycles, nor does it run a distinct course. One child may suffer with a bronchopneumonia extending over ten days or two weeks. Another child with the same form and severity of the disease may suffer from eight to ten weeks. Thus this disease may be considered to be of a distinct wandering type. This disease does not depend on seasonal changes, although the greatest number of cases are met with in the spring and fall.

Etiology.—By far the greatest number of catarrhal pneumonias may be found in those children offering the least resistance. Such cases are usually found in scrofulous, tuberculous, rachitic, and syphilitic children. When children have previously suffered from infections such as diphtheria, scarlet fever, measles, or typhoid fever, they are peculiarly predisposed to this secondary infection. It is for this latter reason that this disease is so fatal. In a series of fatal cases accompanying the various types of diphtheria seen by me at the Willard Parker Hospital, the large bulk succumbed to this complication. This is due in a great measure to the devitalized condition of the body after a toxemic infection, such as is found in diphtheria. Owing to its contagious nature, patients should be isolated.

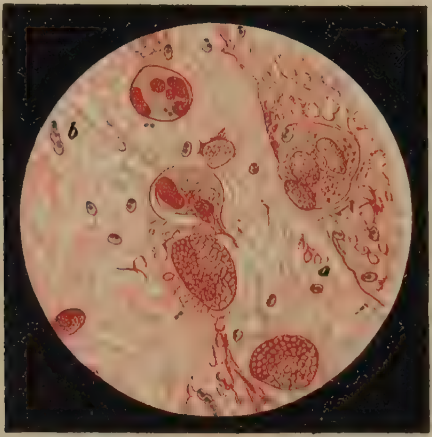


Fig. 124.—Diplococcus pneumoniæ (pneumococcus): (*a*) single diplococci; (*b*) the same in chains (Wolf's double stain). (*Lenhartz-Brooks.*)

Bacteriology.—We know that various forms of germs, such as the staphylococcus, streptococcus, the diplococcus pneumoniæ (Friedlander), the diplococcus (Fraenkel), and bacterium coli, are among the specific micro-organisms which have been found intimately associated with this disease.

Pathological Anatomy.—The tracheal and bronchial mucous membrane is intensely congested, and the lumen of the smaller bronchi filled with thick muco-pus, which adheres to the surfaces and is as tenacious as a pseudo-membrane. The lung at the seat of infection shows dark brown or brownish-red, infiltrated areas, sometimes of a bluish-red color. The surface of the pleura contains large or small hemorrhagic areas. They resemble a sort of hepatization, brownish, grayish, or yellowish-gray in color, and in some areas have purulent infiltrations.

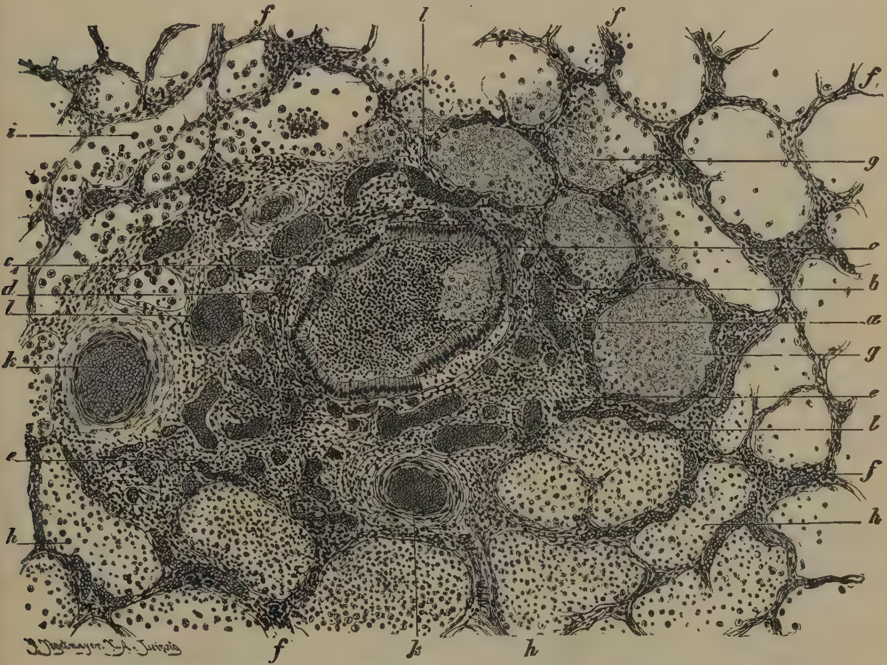


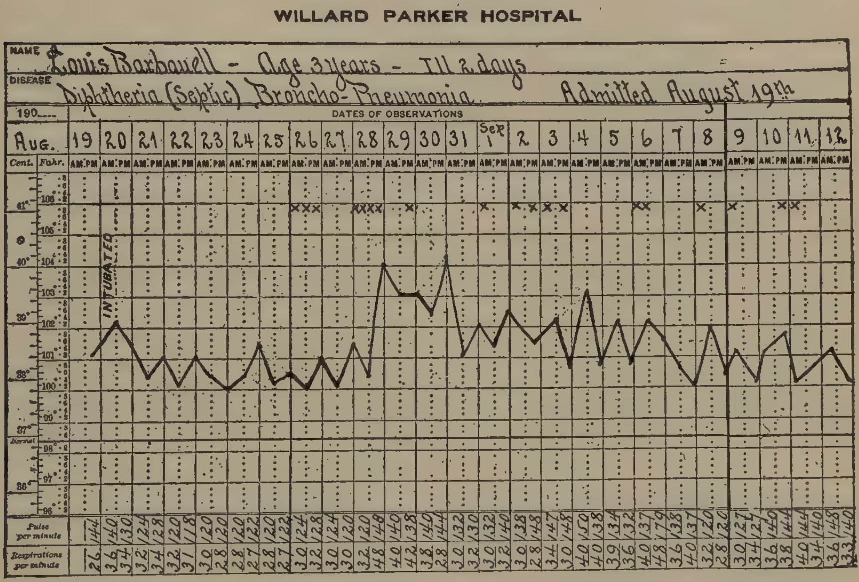
Fig. 125.—Purulent (suppurative) bronchitis, peribronchitis and peribronchial bronchopneumonia in a child 15 months old. (*a*) Purulent; (*b*) mucoid bronchial contents; (c, c^1) bronchial epithelium infiltrated with round cells and partly desquamated (c^1); (*d*) bronchial wall containing strongly congested blood-vessels and infiltrated with cells; (*e*) cellular infiltrated peribronchial and periarterial connective tissue; (*f*) septum between the lung alveoli, partly infiltrated with cells; (*g*) fibrinous exudate in the alveoli; (*h*) alveoli filled with richly cellular, (*i*) with poorly cellular exudate; (*k*) transverse section of pulmonary arteries; (*l*) strongly congested bronchial, peribronchial and intra-acinar vessels. × 45. (*Ziegler.*)

Sometimes the interstitial tissue is associated in this condition with a tendency toward cicatricial formation. Sometimes the alveoli have an emphysematous distention. The whole process seems to be a bronchiolitis associated with circumscribed atelectasis of the lung, from which hyperemia and infiltrations of tissue result.

Symptoms.—The symptoms are those of a bronchial catarrh and a bronchitis. Associated with this there is the usual fever, restlessness, and an increased frequency of respiration; there is also dyspnea. There is a distinct cyanosis affecting not only the face and lips, but frequently the nails. There is an anxious expression to the countenance. The alæ nasi participate in the respiration. The whole respiration seems to be superficial and brings every muscle into action. That there is an obstruction can easily be seen by an observation of the jugulum, by noticing the intercostal space and also the epigastrium, which sinks at each inspiration. The frequency of respiration will sometimes be increased to 70 or 80 per minute, and is very jerky in character. The pulse-rate will suddenly rise to 140 or 160, and frequently in some cases to 200 per minute. The temperature may be as low as 100° F. and gradually rise one degree or more each day. It may reach 104° or 105° F. in the evening. The temperature usually shows a morning remission of at least one or two and sometimes three degrees.

Pictorial illustrations of bronchopneumonia complicating measles and diphtheria will be found in their respective chapters.

Physical Examination.—The physical examination of the thorax shows moist râles, sibilant or sonorous râles, or coarse mucous râles, at times distinct bronchial breathing accompanied by a metallic sound. Percussion will usually show dullness over small areas. While this may be due to the localized area of consolidation, it is quite possible that the dullness may also be attributed to enlarged bronchial glands in this region. When the disease terminates favorably the temperature falls, the pulse assumes a more regular character, the heart sounds, which formerly were feeble, appear louder, stronger, and rhythmic. The cough will be more frequent, the respiration less frequent and not so superficial. Children who formerly were apathetic now appear to notice everything, and appear very sensitive on being handled, and especially so during an examination. The physical signs of a diffused bronchitis and the diffused areas of moist râles associated with the localized areas of bronchial breathing disappear. The bronchial breathing which existed before now becomes vesicular in character. The pulse, which formerly was greatly accelerated, and the respiration, which was very frequent, now both return to their normal state. The whole character of this affection has no specific rule, but drags along without a distinct termination, differing from that condition so well known and described as croupous pneumonia. It is not rare to note an apparent cessation of the inflammatory condition in the pulse, respiration, and temperature, and to find that new inflammation has begun with more active symptoms than has been just passed through.



X Reintubated.

Fig. 126.—Louis B. Aged 3 years. This very instructive case illustrates the tolerance of the larynx for the intubation tube. In all, twenty intubations were performed. The chart illustrates the tube coughed up four times in one day, thus requiring four distinct intubations in twenty-four hours. In spite of the fact that the case was septic from the beginning, and that the child had a bronchopneumonia, the case recovered. In order to retain the tube and prevent its being coughed up, the caliber was gradually increased from a number three until an eleven to twelve tube was used.

We can therefore see that a bronchopneumonia frequently is a continuance of an inflammation which spreads from portion to portion and from lobe to lobe, and thus devitalizes the system. The symptoms affecting the gastrointestinal tract and those of the genito-urinary organs are the same as found in croupous pneumonia.

Catarrhal pneumonia commences with symptoms of a bronchial catarrh or a bronchitis. These same symptoms remain during the course of the disease. The symptoms do not have those of an acute character which characterize croupous pneumonia, but rather assume a chronic appearance. The great danger consists in the development of pus infiltration in the lungs, and it is only by the rapid emaciation that symptoms of *miliary tuberculosis* can be suspected.

We can differentiate catarrhal pneumonia from atalectasis by the total absence of fever in atalectic conditions.

Prognosis and Course.—The prognosis depends on the origin of this disease. If, for example, bronchopneumonia is a sequel to measles, diphtheria, whooping-cough, scarlet fever, or typhoid, and the child has passed through a severe infection in which the corpuscular elements of the blood have greatly suffered, then the prognosis is grave. If, on the other hand, this disease commences as a primary affection and the child is in a fairly well-nourished condition, then the prognosis is good. The prognosis will chiefly depend on the amount of food that can be properly assimilated and the care with which the case is nursed. The course is slow and tedious and may develop tubercular pneumonia.

The hygiene is very important in this condition. The prognosis of catarrhal pneumonia following whooping-cough, measles, or diphtheria will usually show that almost 70 per cent. of cases so affected are fatal.

Treatment.—If the temperature is high, antipyretic remedies, such as the coal-tar products, are not indicated, owing to their well-known depressing effect upon the heart. The author has never used them without seeing an ill effect. When they are used they should be combined with camphor or musk to counteract this well-known depression. The safest antipyretic measure in pulmonic affections is undoubtedly hydrotherapy. A cold compress applied over the thorax and repeated once every half-hour, not only acts as an antipyretic, but will stimulate the respiratory muscles and provoke deep inspirations. This will distend the smaller portions of the alveoli and will prevent atelectasis pulmonum. If there is very great dyspnea owing to the presence of viscid secretions, then an emetic is indicated.

One of our best emetics is sulphate of copper in 1-grain doses, repeated in an hour if necessary. Another emetic and one which is less irritating than the above is syr. scillæ comp. in ½ to 1 teaspoonful doses, repeated every half-hour until the desired effect is produced. Syrup of ipecac in doses of one teaspoonful, repeated every fifteen to twenty minutes, is also serviceable.

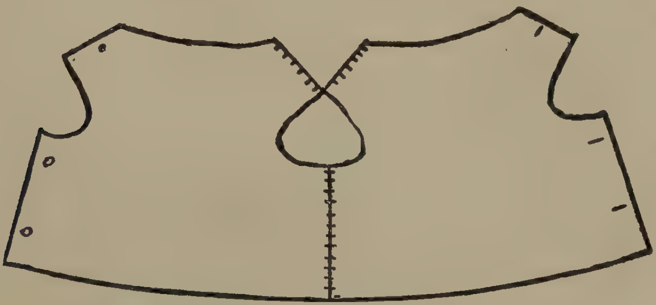


Fig. 127.—Diagram of pneumonia jacket opened at side.

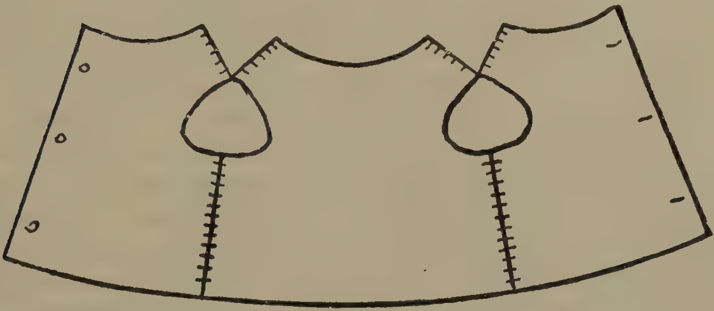


Fig. 128.—Diagram of pneumonia jacket opened in front.

When a child has extreme dyspnea and it is not wise to administer an emetic by mouth, then a hypodermic injection of ¹⁄₁₀ grain of apomorphia dissolved in five or ten minims of sterile water injected deeply into subcutaneous cellular tissue will usually provoke emesis. If this dose is not effectual in fifteen or twenty minutes, then another dose of apomorphia may be given. Tartar emetic in doses of ¹⁄₁₀ grain, in sweetened water, may be given every hour until vomiting is produced. It is better not to change from one drug to another unless several doses have proven ineffectual.

Flaxseed poultices are sometimes recommended when the secretions are very viscid. They have frequently proven efficacious in the hands of the author. In urgent dyspnea great relief can be afforded by the application of dry cups over the affected areas of the lungs.

A pneumonia jacket consisting of cheesecloth, which is worn next to the skin, then a layer of cotton-wool, and the whole covered with oiled silk or oiled muslin will serve to prevent chilling of the surface. Figs. 127 and 128 show diagrams of these jackets.

Internal diffusible stimulations, such as $\frac{1}{2}$-grain doses of carbonate of ammonia, repeated every hour, are serviceable. Liq. ammon. anisati, in doses of from 3 to 10 drops, repeated every hour, is one of our best diffusible stimulants. If symptoms of collapse appear then active alcoholic stimulation must be resorted to, such, for example, as champagne, brandy, whisky, or wine *ad libitum.* In addition thereto, a sinapism over the front and back of the chest and mustard foot baths may be required. Hypodermic medication will frequently be found necessary, especially if the heart action is feeble. One two-hundredth of a grain of nitro-glycerine injected hypodermically or caffeine citrate will sometimes work well. Strychnine sulphate in doses of $\frac{1}{200}$ grain, gradually increased, repeated every three or four hours or oftener, will stimulate the heart action. An excellent heart stimulant is to give 1 drop of tincture of musk every hour.

If the cough is very troublesome, especially at night, and the child is in a fair physical condition, then codeine in doses of $\frac{1}{20}$ to $\frac{1}{10}$ grain for a child 1 year old, repeated every two or three hours, will relieve. Dionin is a remedy that has been used by the writer with considerable success in the treatment of various forms of cough in doses of $\frac{1}{20}$ grain, repeated every three or four hours, for a child 1 year old.

Stimulating expectorants such as syrup of senega, in doses of from 10 to 15 minims, may be advantageous. The vital point to remember is to support the system with nourishment. If the child will not take food per mouth, then rectal feeding consisting of nutrient enemas is demanded.

Water should be given freely during the course of a bronchopneumonia to stimulate the action of the kidneys.

III.

DISEASES OF THE PLEURA.

PLEURISY.

An inflammation of the pleura is by no means rare in children. It is found very frequently post-mortem, although no evidence of the same existed *intra vitam*. It may be a primary condition.

There are two distinct forms of pleurisy usually seen: 1. Pleuritis sicca (dry pleurisy). 2. Pleuritis exudativa. The latter form can again be divided into (*a*) serous, (*b*) sero-purulent, (*c*) purulent, (*d*) hemorrhagic.

The last mentioned is a rare condition. It is seen in traumatic conditions, in hemophilia, and occasionally when tuberculosis is present.

DRY PLEURISY.

This form of pleurisy usually follows an exposure to cold, although it may follow as a secondary inflammation to the lung. There is usually an exudation of fibrin only.

Pathology.—The pleura is swollen and thickened, and there is an exudation of fibrin. Adhesions frequently result from these bands of fibrin between the opposite pleural surfaces. The pleura loses its natural luster. When the process ceases and the lymph is absorbed, the condition is called "dry pleurisy." The fibrinous bands between the pleura costalis and pulmonalis usually leave permanent adhesions.

Symptoms.—The disease is usually ushered in with high fever, which may reach 104° or 105° F. Cough is usually present. It is a short, hacking, irritating cough. It is accompanied with pain. As a rule, children cry during each coughing paroxysm. A characteristic symptom often noted is that a child suffering with pleurisy usually places its hand over the affected area during a coughing paroxysm. This lends support to the ribs and relieves pain. There is no expectoration. A friction sound or a fine, crepitant râle is heard over the affected area. There is vesicular breathing. The percussion note is rarely normal. The tongue is usually coated. The bowels are constipated. The urine is scanty. The surface of the body is dry and warm. There is usually a gradually increasing dyspnea. The pulse-rate is increased; so also are the respirations. The symptoms resemble those of a pneumonia and can rarely be differentiated without a careful physical examination. There is usually pain on percussion over the affected area. The children do not wish to be handled, but prefer to lie quietly.

The diagnosis depends on the symptoms above described. We must bear in mind the frequency with which pulmonary complications are associated.

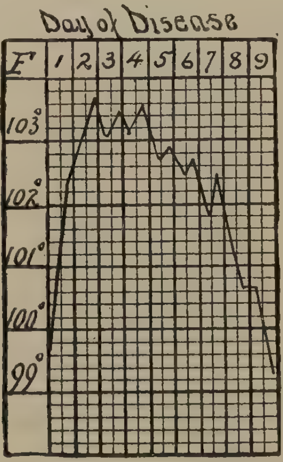


Fig. 129.—Fever curve in a case of dry pleurisy.

The prognosis is usually good, although adhesions frequently remain.

Treatment.—Counter-irritation, such as cupping of the chest, the application of iodine over the affected area, or painting with cantharidal collodion, acts well. Strapping the chest with broad straps of adhesive plaster or the application of a very tight fitting bandage seems to support the chest and relieve the cough. Calomel is indicated, especially if constipation accompanies this condition. Iodide of sodium, with very small doses of codeine, may be given at regular intervals to relieve pain. A full dose of codeine or morphine may be given at night if the cough is distressing or the pain acute. I have given from $\frac{1}{30}$ to $\frac{1}{20}$ grain of morphine hypodermically to a child 2 years old to relieve a severe cough.

PLEURISY WITH EFFUSION (PLEURITIS EXUDATIVA).

This secondary form of, pleurisy is usually a complication or an extension of the infection in pneumonia. It is frequently met with in influenza and in infectious diseases. I have frequently seen pleurisy with effusion in the scarlet fever wards of the Riverside Hospital. I have also seen pleurisy complicating tuberculosis and rheumatism in children.

Bacteriology.—In some cases the streptococcus, in others the staphylococcus, is present. A diplococcus has also been found and believed by some to be the cause of pleuritis. The pneumococcus has been found present, so that it is difficult to state which pathogenic microbe is the true cause of this condition. Whether this microbe gains entrance to the pleura from the lung by inhalation or through the skin, or whether the tonsil is the means of entrance of the pathogenic bacteria causing this disease, has not been definitely determined. We know that suppuration in other parts of the body, as, for example, in the abdomen or in the spine, can frequently carry microbic elements to the pleura and thus directly transmit the infection. Pyogenic bacteria may be carried to the pleura through the lymph channels and by the blood.

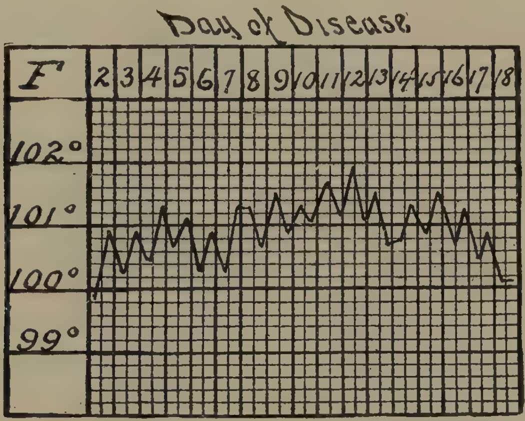


Fig. 130.—Fever curve in a case of pleurisy with effusion.

Pathology.—This form of exudative pleurisy is the one most frequently encountered. We rarely find both sides involved, although a double-pleurisy is by no means rare. The pathological condition is practically the same as described in the article on Dry Pleurisy. In this condition we have more or less serous effusion. The serum may be clear, it may be bloody, or it may be turbid. Serous effusions found in a healthy child are usually absorbed. Adhesions are frequently left in this form of pleurisy.

Symptoms.—The fever may be high or low. Fever and general malaise accompanied by a hacking cough will frequently be the only symptoms. I have frequently seen children brought to my clinic with the history of *a cough, no expectoration,* anorexia, with general weakness and emaciation, in whom a pleurisy with a large effusion was detected.

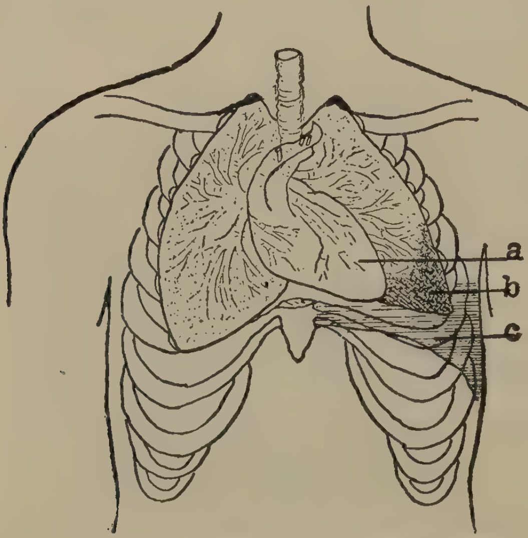


Fig. 131.—Diagrammatic illustration of heart and lungs in a left-sided pleuritic effusion; *a,* heart; *b,* compressed lung, area of bronchial breathing and crepitant râles; *c,* effusion.

Diagnosis.—The diagnosis in very young children is at times difficult. It can only be made by a most careful physical examination of the chest.

Physical Signs.—Before the effusion is marked, and during its absorption, friction sounds are heard over the inflamed area. *After the effusion* is present there are no friction sounds. There are an absence of râles, distant bronchial breathing, and *flatness* on percussion. There is diminished breathing, so that the voice or the cry of the child will appear very distant. At the level of the fluid the voice has a tremulous sound, known as *ægophony*. There is a bulging of the intercostal spaces. The breathing is bronchial or tubular. Not infrequently the heart is displaced. A careful inspection of the chest will show that there is a loss of motion on the affected side during respiration.

In some cases the diagnosis depends on the result of an exploratory puncture with a clean (aseptic) needle having a large caliber. One of the best needles for this purpose is one similar to that used for the injection of antitoxin. A puncture should be made after washing the skin with soap and water followed by alcohol or ether. The needle is then inserted about one inch. Sometimes it is necessary to make several exploratory punctures in order to find the liquid, especially so in the encapsulated form of pleurisy, where a small area is involved. After withdrawing the liquid the character of the same should be determined by examining it under the microscope. If pus corpuscles are found we should insist on an operation, as no other treatment will be satisfactory. Not infrequently a serous effusion will be absorbed if in making an exploratory puncture, some of the fluid is drawn off, so that the puncture is at times a very valuable therapeutic adjunct.

Treatment.—Firm strapping of the chest with bands of adhesive plaster is useful; 5- to 15- grain doses of iodide of sodium, according to age, may be administered three times a day in milk, soup, or broth. Fresh air should be constantly permitted. If pain is absent, gentle but long inspirations and expirations (pulmonary gymnastics) are worth trying. By properly exercising the lungs we can stimulate nutrition to the parts and frequently assist in the absorption of an effusion.

Dietetic Treatment.—No matter what form of treatment is instituted, nothing will avail so much as proper feeding. The dairy products—milk, eggs, and cheese—in conjunction with cereals and fruits, should form the bulk of the food ordered. Concentrated soups and broths are also useful.

EMPYEMA (PURULENT PLEURISY).

Etiology.—As a rule we find this disease following pneumonia or pleurisy. It is a favorite complication of the infectious diseases, so that after a pneumonia in an acute infectious disease we must not be surprised to find an empyema.

Bacteriology.—The bacteria most frequently found are the streptococcus, the staphylococcus, and the pneumococcus. Rarely has the tubercle bacillus been found.

Pathology.—The surface of the pleura is covered with fibrin and pus and the cavity filled with a purulent exudate, the result of this inflammation. The pus settles to the bottom of the pleural sac.

Not infrequently both pleuræ become involved, although the rule is to find but one pleura or part of it affected. When not treated the pus may rupture into the lung or burrow externally through an intercostal space.

Symptoms.—*The most pronounced symptoms are flatness on percussion and diminished respiratory sounds. Sometimes they are totally absent. There is also a loss of the vocal fremitus. At the level of the fluid the voice has a tremulous quality known as ægophony.*

Above the fluid the breathing is broncho-vesicular due to the compressed lung. Pleurothotonos is sometimes seen.

There is an absence of expansion of the chest on the affected side. When this condition exists on the left side it may displace the heart.

I rely upon the examination of the blood, in addition to the physical signs given, as an important guide in determining the presence of pus in the system. See article and illustration of Blood Reaction of Pus in the chapter on Blood.

Diagnosis.—If the fever continues after a case of pneumonia, or pain in the chest persists accompanied by dyspnea, cough, and sweats, then empyema should be suspected.

When the disease progresses the temperature frequently returns to normal or nearly so. The child shows symptoms of general exhaustion, emaciation, and is extremely anemic. Diarrhea is a frequent symptom in this condition.

The physical signs above noted are usually positive. When there is any doubt, and in order to confirm the symptoms pointing to an empyema, an exploratory puncture should be made.

If the needle is sterile and sharp and the surface to be punctured is rendered aseptic, then there is no risk in making one or more punctures to aid in establishing the diagnosis.

Choice as to Where the Needle is to be Introduced.—My plan has always been to find by percussion the area having the greatest dullness or flatness, and insert the needle after noting the following:—

Points to be Noted while Making an Exploratory Puncture.—The skin should be washed with soap and water, dried, and again washed with alcohol, and lastly with ether. The needle should be boiled before being used.

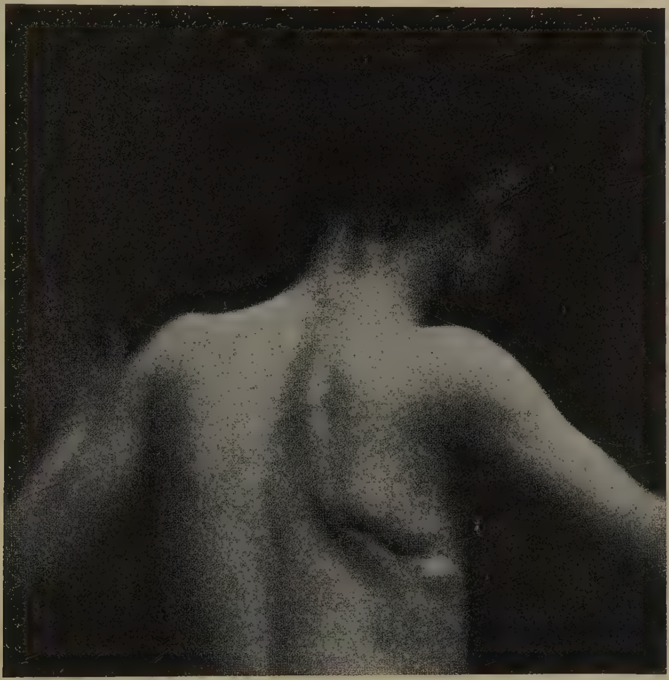


Fig. 132.—Illustrating a severe localized, right-sided empyema. Two ribs were resected. The child made a complete recovery. The thorax shows very slight deformity after the operation.

If the needle is introduced on the right side, due allowance must be made for dullness in the region occupied by the liver. Do not introduce the needle too near the region of the spine, but choose rather an intercostal space in the axillary line or preferably below the scapula on either side. If the needle is introduced on the left side do not push it too forcibly nor too deeply or hemorrhage may result. Sometimes the fluid is fibrinous and will not readily enter the caliber of the needle. If the needle is plunged too far and enters a dilated bronchus, due allowance must be made for a purulent secretion, which should not be mistaken for empyema.

Prognosis.—This depends upon the general condition at the time of the operation. If the tubercle bacillus is found in the pus the prognosis is bad. The longer the disease existed the more doubtful the prognosis. If the condition is a sequela to a pneumonia or a pleurisy then the prognosis is good.

Course.—The tendency of empyema in a child is to recovery. Out of 20 cases operated by me, 18 recovered in four to five weeks. One case recovered after six months of continued surgical treatment, and was operated three times. One case was ill over two years, tubercle bacilli being found.

Surgical Treatment.—When pus is located, the indication is to remove it. After painting the area with tincture of iodine an incision should be made at least two inches long through the skin, and parallel with the rib. If the pus is thin in character a simple intercostal incision carried into the pleura will evacuate the same. If the pus contains fibrinous coagula, it is better to resect one or two ribs. Care must be taken to preserve the periosteum in resecting the ribs. By this latter method we have complete drainage, and if the case is treated on general aseptic principles with drainage, irrigation, and restorative treatment, the outcome is usually good.

Points to be noted in empyema cases:—

1. *Anesthetic.*—Do not use general anesthesia if cyanosis, marked dyspnea, or other severe toxic symptoms are present.

Local anesthesia, such as ethyl chloride or novocaine, can be used.

2. *Regarding Antisepsis.*—When pus is located we must resort to the usual details of asepsis and antisepsis. The instruments should be rendered thoroughly aseptic and the child should be given a bath on the day of operation in addition to a thorough scrubbing of the seat of operation.

The physician, if a general practitioner, should not operate if he has been in contact with an acute infectious case; neither should he operate if he has a case of erysipelas or diphtheria under his care.

While pus is being evacuated, turn the child from side to side, to empty the pleural cavity. If the heart action is poor this should not be done.

A large-sized drainage tube should be inserted into the wound. The pleural cavity should then be washed with a weak Carrel-Dakin solution. It is important to have a cross-section of rubber tube or a large safety pin attached to the drainage tube; otherwise, as has already happened, the tube may be lost in the cavity.

Excepting when large coagula are present, as in pneumococcus empyema, the syphon drainage (Kenyon method) may be recommended. This form of drainage is especially indicated in streptococcus empyema; however, this type is extremely rare in children.

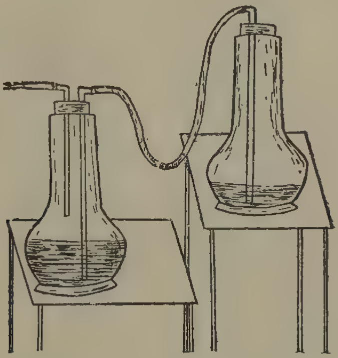


Fig. 133.—James apparatus for expanding the lungs in empyema.

Treatment.—The treatment consists in building up the system with tonics of iron, codliver oil, malt, sea-salt bathing, and fresh air, in addition to a nutritious diet, of which milk, eggs, and cereals should form the bulk.

Stimulation will be urgently required. In other words, our aim should be to build up the body to withstand the shock of the operation, and at the same time to nourish and restore the general weakened condition.

After-treatment.—Strict asepsis. Change dressings daily. Use clean drainage tube and fresh gauze. Remember the danger of iodoform poisoning in using large strips of iodoform gauze.

Give nutritious food. Sometimes a change of air to the mountains or seashore will aid in recovery.

Eighty per cent. of all cases in which a simple incision is made do not require after-treatment. Twenty per cent. of cases require resection of the ribs and frequently additional surgical treatment for chronic empyema.

James Apparatus.—Pulmonary gymnastics, such as inspiration and expiration, should be frequently practiced to aid in the expansion of the lung after an operation for empyema. A clever device is known as the James apparatus, by which a colored liquid can be blown from one bottle into another. This may be given to the child as a toy, and is very valuable as a means of producing deep inspiration and expiration.

CHRONIC EMPYEMA.

Neglected cases or those of long standing frequently require additional treatment. Adhesions will frequently form, preventing the normal expansion of the lung. A small opening or sinus containing exuberant granulations will be seen. In some cases seen by me pus has oozed for months. In a case of this kind nothing will do as well as a radical operation such as Estlander recommended (thoracoplasty). The adhesions must be broken up and thorough drainage allowed. When such a radical operation is performed, deformity usually follows. These cases belong to the surgeon.

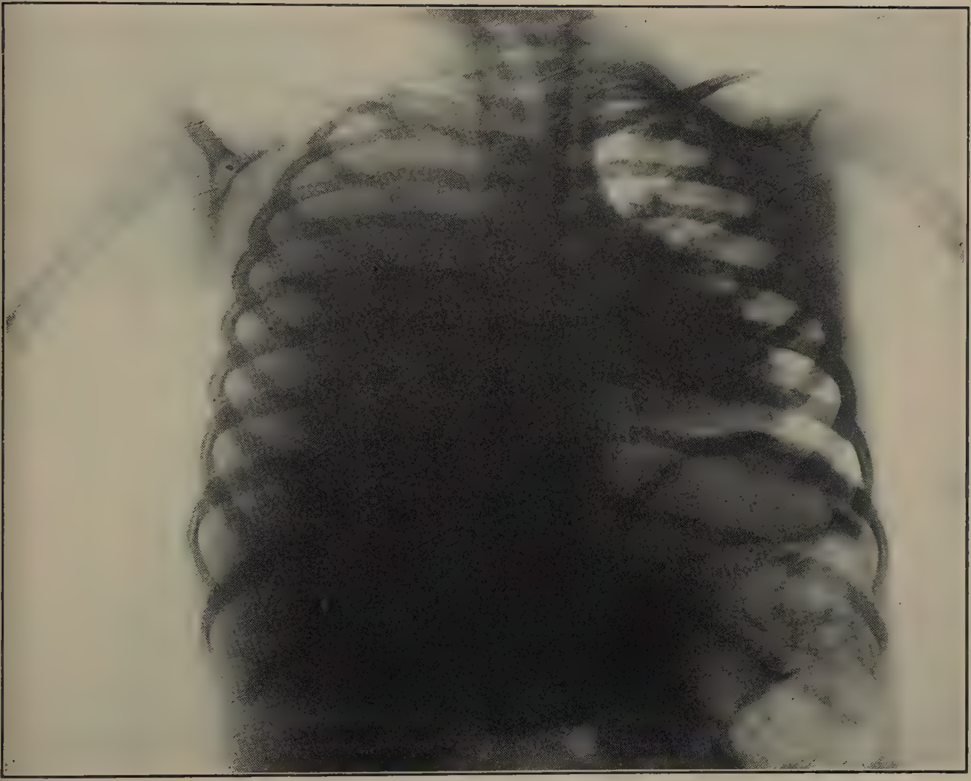
TUBERCULAR EMPYEMA.

This condition, while rare, has been seen by me twice during the last five years. It is found in families where tuberculosis exists. We must bear in mind that a tubercular empyema may be the complication of what was formerly a non-tubercular type.

Environment and heredity play an important part in the etiology of this condition. Just as a tuberculosis may follow the bronchopneumonia of measles, so I believe that tubercular empyema may also develop.

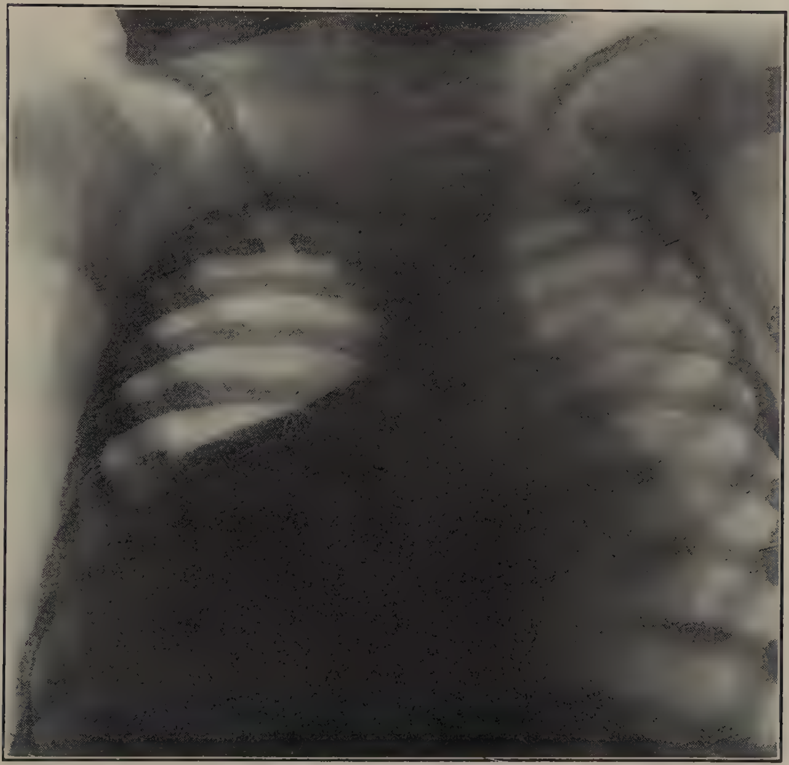
The excellent results which have been reported during the last few years by the treatment with an artificial pneumothorax, and the injections of nitrogen, lend encouragement in the treatment of this fatal disease. From my own experience I strongly favor this method in every case in which tuberculosis exists.

PLATE XXX



Pleural effusion. Right side.

PLATE XXXI



Pneumothorax. Right upper lobe. Note absence of lung markings. The lung has collapsed to the base and merges with the cardiac shadow.

PNEUMOTHORAX (HYDRO-PNEUMOTHORAX: PYO-PNEUMOTHORAX).

Air alone in the pleural cavity is a very rare condition. It is usually associated with a serous fluid—hydro-pneumothorax, or with pus—pyo-pneumothorax.

Etiology.—This condition may follow an exploratory puncture made by an aspirator or a small needle. It rarely follows fracture of the rib even though the lung may be torn. The most common cause is perforation of the lung as when rupture of the air vessels during straining takes place. Less common causes are due to septic broncho-pneumonia and gangrene. A rare cause is the breaking of a hemorrhagic infarct in chronic heart disease. Perforation of the lung from the pleura, which arises in certain cases of empyema produces a pleuro-bronchial fistula.

Of 48 cases, the basis of Emerson's monograph (Johns Hopkins Hospital Reports, vol. xi), 22 were tuberculous, 6 were the result of trauma, 10 of aspiration, 2 were spontaneous, 2 followed bronchiectasis, 2 abscess of the lung, 1 gangrene, 2 an empyema, and 1 an abscess of the liver perforating through the lung.

Symptoms.—Dyspnea and pain on the affected side are the most prominent symptoms. There is an irritant cough with an increase in the amount of expectoration. In severe cases the pulse is feeble and rapid. There is sweating with great respiratory distress. The color becomes livid. Some cases have been reported that became unconscious and died within twenty-four hours. The patient usually lies on the affected side. There is a displacement of the heart. On inspection one can see marked enlargement of the affected side. Percussion gives a tympanitic or an amphoric quality. It may however, be a dull tympany or a full hyperresonant note like emphysema. In other cases there is dullness. Walsh states that error in diagnosis may result from ignorance of the fact that the percussion note may be muffled, toneless or almost dull. The coin-sound, termed by Trousseau the *bruit d'airain,* is very characteristic. To obtain it the auscultator should place one ear on the back of the chest wall while the assistant taps one coin on another on the front of the chest. The metallic echoing sound which is produced in this way is one of the most constant and characteristic signs of pneumothorax. The X-ray shows an abnormally clear zone without the normal lung markings, the shadow of the collapsed lung is not always easy to see, and the visceral displacements.

An aneurism pressing on the bronchus may cause great inflation of the lung and a condition which gives clinical and X-ray features suggestive of pneumothorax.

Treatment.—Strapping the chest, and sedatives such as codeine and heroin will lessen cough. Immediate aspiration with a trocar has saved life. Pleurotomy or resection of one or two ribs if pus is present, is indicated.

IV.

DISEASES OF THE LUNGS.

PNEUMONIA (LOBAR OR CROUPOUS).

THIS acute infectious disease is frequently seen in infancy and childhood. It is caused by the invasion of a specific micro-organism, generally the pneumococcus; also known as the micrococcus lanceolatus. The disease rarely exists longer than from six to nine days. It terminates by crisis. It is a self-limited disease. In some cases it may terminate by lysis.

Etiology.—This disease most frequently exists in children between the ages of 5 and 10 years. Baginsky states that, among 173 pneumonias studied by him, he found the following:—

6 children less than 1 year old.
28 children between 1 and 2 years.
58 children between 2 and 5 years.
63 children between 5 and 10 years.
18 children between 10 and 14 years.

We find on studying the above cases that the greater number of pneumonias are found in children between the ages of 5 and 10 years. Schlesinger studied a series of cases of pneumonia and found that 96 cases affected the right lung as against 66 cases affecting the left lung. He also found on the right side of the lung:—

22 cases affecting the upper lobe.
7 cases affecting the middle lobe.
32 cases affecting the lower lobe.

On the left side of the lung:—

11 cases affecting the upper lobe.
0 cases affecting the middle lobe.
47 cases affecting the lower lobe.

Thus he found that the lower lobes on both sides of the lungs were more frequently affected than the upper lobes, and that the seat of pneumonia in children corresponded with the investigations of von Dusch, showing that the most frequent seat of pneumonia of the lobar variety is certainly found at the base of the lower lobe of the left lung. This is an important diagnostic point when symptoms point to the development of pneumonia.

The stertorous breathing during anesthesia, frequently aspirates the coccus of sputum septicemia (pneumococcus) and is the cause of the lobar pneumonia which follows. (Post-operative aspiration pneumonia.)

Bacteriology.—The disease originates by an invasion of a specific micro-organism first described by A. Fraenkel. Other investigators, among them Klebs, Ziehl, and C. Friedlander, have found various micro-organisms in the lymph channels, and in the alveoli of pneumonic lungs. Some of these germs have been encapsulated. It remained, however, for Fraenkel to find the specific germ causing this disease. Weichselbaum was one of the first to prove the positive specific infection of the Fraenkel diplococcus. This diplococcus is found not only in the lungs, but frequently also in the meninges, in the nasal secretions from the nasal mucous membrane, and at times in the kidneys. Whenever this micro-organism is found there is usually an inflammatory condition resulting therefrom.

When this specific germ was injected into animals, pneumonia always resulted.

In a series of 500 cases of pneumonia at the Rockefeller Institute 94.5 per cent. were caused by the pneumococcus, 3.1 per cent. by the streptococcus, 1.2 per cent. by the influenza. The pneumococcus cases were of, Type I, 33 per cent., Type II, 31 per cent., Type III, 12 per cent., and Type IV, 24 per cent.

The mortality in Type I was 25 per cent., Type II, 32 per cent., Type III, 45 per cent., and Type IV, 16 per cent.

The organisms of Type IV found in the mouths of most individuals have the lowest virulence, Type III, having the smallest percentage of cases, are the most virulent. The prognosis in Type III is usually bad. Types I, II, and III are specific organisms, Type IV is a group of pneumococci which have as yet been undifferentiated.

Pathology.—The infection is usually caused by the pneumococcus. In pleuropneumonia both the visceral and the parietal pleura are coated with a large layer of yellowish-green fibrin, in thick, shaggy masses, by which the lung is adherent to the chest-wall, the diaphragm, and the pericardium. The exudation varies between one-eighth and one-half inch in thickness. It can often be stripped from the lung or scraped from the chest-wall

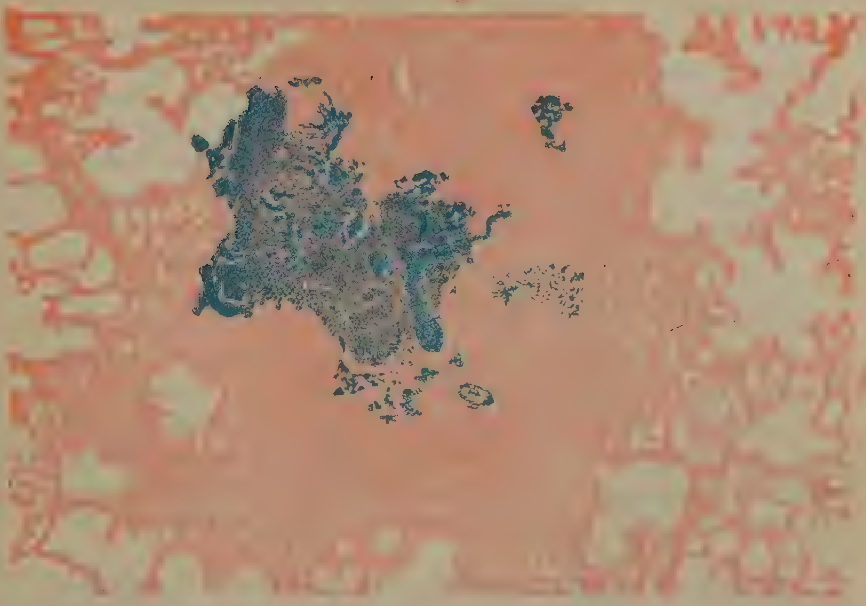


Fig. 134.—Focal metastatic hematogenous streptococcus pneumonia following angina. (*a*) Pneumonic focus with streptococci (blue); inflamed surrounding tissue. × 80. (*Ziegler.*)

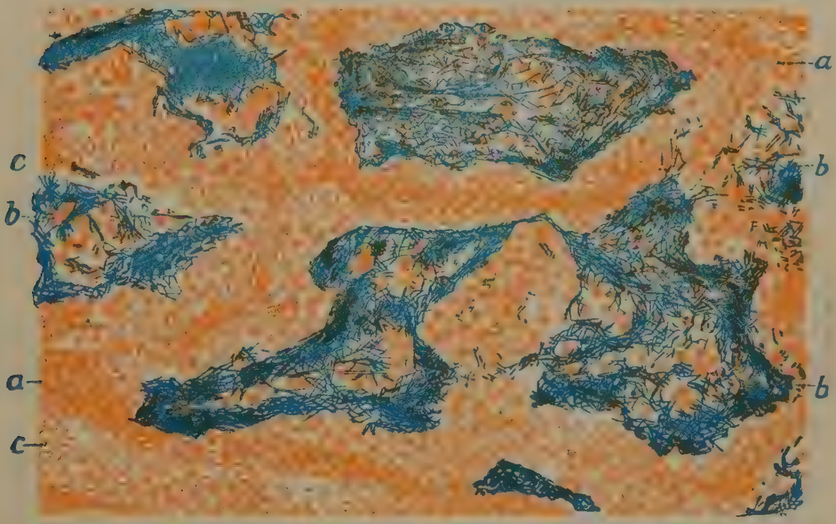


Fig. 135.—Croupous pneumonia. Red hepatization of the lung (alcohol, carmine, fibrin-stain). (*a*) Infiltrated alveolar septa; (*b*) fibrinous exudate; (*c*) red blood-cells. × 200. (*Ziegler.*)

by the handful. In its meshes small pockets may form, which contain only a few drops or sometimes a dram of pus, or, less frequently, serum. This is the condition in which the lung is usually found when death has occurred at the height of the disease. If the process has lasted longer, larger collections of pus may be present. The lung itself shows the usual changes of pneumonia, and if there has been any considerable accumulation of fluid there are in addition the evidences of compression.

With pleuropneumonia of the left side, the pericardium is occasionally involved. This was seen in two of my cases, the lesions closely resembling those of the pleura. In two cases there was also meningitis, and in one peritonitis, the exudation in all cases having the same characteristics.

There are four stages which have an important bearing on the progress and on the outcome of this disease: First, the stage of congestion; second, the stage of red hepatization; third, the stage of gray hepatization, and, fourth, the stage of defervescence or resolution.

Symptoms and Course.—The disease is usually ushered in with convulsions. At times vomiting and diarrhea may be the first symptoms noticed. Chills are very rarely seen in children. The cheeks are usually very red and show the characteristic flush so well known in adult pneumonia. The respirations are increased, the pulse is accelerated, and the temperature rises. One of the most important diagnostic points and one upon which I lay great stress is the *"ratio between the pulse and respiration."* Normally the ratio is 1 to 4, and when this ratio is increased, as, for example, when there are 60 respirations and 140 pulse beats, then the ratio of 1 to 4, which normally existed, is disturbed. By this disturbed ratio alone we can frequently make a diagnosis. Especially is this true in those cases of "central pneumonia" in which the disease develops in the center of the lung and gradually spreads toward the periphery. When such central pneumonia exists, the physical signs will be so masked that bronchial breathing will be hardly discernible. The temperature will suddenly rise to 102°, 103°, and frequently to 105° F. The temperature in rachitic children will sometimes rise to 106° and 107° F. It is this class of cases that shows the most severe form of depression from irritation of the thermic centers. In these rachitic children we usually note that the invasion of pneumonia begins with a convulsion or a series of convulsions.

We should not depend on the disturbance of the pulse and respiration ratio in all cases of pneumonia. Many cases of pneumonia show little alteration in the respiration. There is neither labored breathing nor increase in frequency of respiration. Toxic manifestations such as drowsiness and a full and bounding pulse may be the only signs outside of an increase in the temperature and the usual pulmonary symptoms. The latter, consisting of dullness on percussion, bronchial breathing, and marked bronchophony will be sufficient to establish the diagnosis. A blood count usually shows a marked leucocytosis of at least 15,000 to 20,000 or higher. This leucocytosis will aid in excluding meningitis besides supporting the physical signs of a lobar pneumonia. Cough and expectoration are not always present and should not be depended upon.

In a case recently seen toxic symptoms prevailed. The temperature ranged between 104° and 106° F., pulse 130 and respiration 22 to 24. Owing to the intense toxemia and the drowsiness, meningitis was suspected. The usual cerebral symptoms such as Kernig's and Brudzinski's signs were absent. There was no rigidity nor delirium present. Lumbar puncture was suggested. On the following day, however, lobar pneumonia was noted and the meningeal symptoms gradually subsided.

In this case there was an acceleration of pulse and rise in temperature, but the respiration remained near normal throughout the course of the disease.

Children old enough will frequently complain of abdominal pains. Thus we must not be misled by gastric or gastrointestinal symptoms until we can exclude the lungs as the seat of the disease. The physical sign most commonly associated with this disease is dullness on percussion over the affected area of the lung. In addition thereto there will be bronchial breathing. If the child cries, a loud bronchophony will be heard. There will also be an increased vocal fremitus. These symptoms usually remain the same for a few days, although they may increase in intensity.

Between the sixth and the ninth day, rarely earlier and very rarely later, a crisis takes place, in which the temperature will suddenly drop to normal. The patient will be covered with a profuse perspiration; the pulse, which formerly was full, bounding and accelerated, will be found smaller and less frequent. The former flush which existed will give place to a distinct pallor of the skin, and the observant physician will note a decided change in the patient. This condition, known as the crisis, may come on suddenly or gradually. In some cases the fever drops slowly —*i.e.,* by lysis—until normal is reached.

Pulse.—The pulse-rate is one which is a very important factor in connection with this disease. While it may be 120 and be quite regular in action, it is not uncommon to find the pulse-rate 140, and even 160. The frequency of the pulse is not as important a factor in determining the progress of this disease as is the character of the pulse. Thus, to illustrate, if a pulse is not frequent, but is weak and arhythmic, such a patient should be regarded as in imminent danger and requiring very frequent and careful stimulation. A condition of collapse may be looked for in such a patient, and treatment directed to the prevention of the same is indicated. If the pulse-rate has been 120, and it suddenly increases to 140 or more, then some complication must be suspected and the child carefully examined to determine the cause of this sudden increase of the pulse-rate.

Respiration.—The whole respiratory condition is superficial and seems to call the accessory respiratory muscles into play. When the respiration is above 40 per minute, the diagnosis is usually very positive.

Lack of Expansion.—A lack of expansion may also be noticed. It involves the whole of the affected side and is not limited to the subclavicular region. In pneumonia this lack of expansion in the subclavicular region is marked, even though the inflammatory process is situated at the base. It can be observed as early as the first day, and lasts throughout the entire course of the disease. This early appearance of the sign is of especial importance, since the physical signs of involvement of the lung are so frequently delayed in cases of infantile pneumonia.

The sign is best elicited in the dorsal position, and is easily seen on the exposed chest in quick respiration.

One writer says he has recognized by this sign alone, pneumonia occurring in a supposed case of appendicitis, and also has discovered pneumonia complicating typhoid and influenza.

The Temperature.—A rise of temperature usually implies the invasion of the specific micro-organism and hence is one of the earliest symptoms of this disease. It usually rises from 102° to 105° F., and remains so until the crisis. There is, however, a morning remission; thus we find the temperature about one degree lower in the morning than we do in the evening. In pneumonia we frequently find a condition known as the "procrisis." This procritical stage exists one day before the crisis, as a rule. The temperature will suddenly fall to normal on the day preceding the crisis. It has a valuable prognostic significance, showing that the inflammatory stage has terminated.

In Pleuro-pneumonia.—Symptoms: The friction sound is the characteristic feature throughout. In addition to the pleuritic friction sounds, the symptoms of pneumonia, such as bronchial breathing and bronchophony, are found. There is marked dullness and frequently flatness on percussion. This condition is sometimes misleading. Not infrequently the signs of distant breathing and flatness on percussion, in addition to a continuous high temperature, will simulate an empyema. An exploratory needle should be introduced. It may strike a small pocket of pus and thus an empyema may be detected. Some of these cases, if operated, frequently show

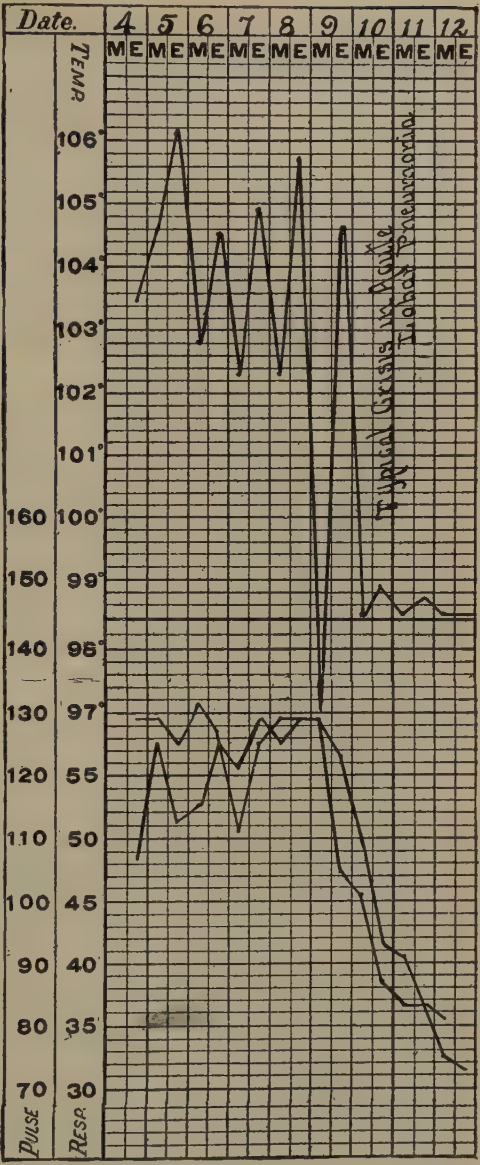


Fig. 136.—Lobar pneumonia of a severe type. The effect of the poison is easily seen by studying the pulse-rate. Case recovered.

nothing but the ordinary signs of adhesions so common at this stage of the disease.

The Blood in Pneumonia.—Baginsky maintains that the examination of the blood will show the progress of this disease, and he believes that the leucocytosis so common in this disease has an important bearing on the prognosis of this condition. Felsenthal and Schlesinger, also Monti, Berggrün, and Loos, have found that there is an increase of the polynuclear cells, whereas the eosinophile cells disappear. When the temperature returns to normal during the crisis in pneumonia, the leucocytosis which formerly existed also disappears. Thus, some authors speak of a "blood crisis."

The Urine.—This is frequently high-colored and very scanty, especially so during the height of the disease. It also has a very high specific gravity and frequently contains albumin. Acetone can also frequently be found in the urine. The albumin frequently disappears after the crisis. The phosphates may be increased, though some authors maintain that they are decreased during the progress of this inflammatory type of disease. The diazo reaction is only found in that form of pneumonia which seems to have a typhoid tendency. Indican is very rarely or never found unless there is some form of intestinal putrefactive complication.

Relapse.—It is not infrequent to have one and the same area of lung reinvaded; thus the disease may run a second course over the same portion of the lung just as it did in the first attack.

Cerebral Manifestations in Pneumonia.—This type of the disease is one which is very frequently met with in which the symptoms of pneumonia are chiefly complicated by meningeal symptoms; thus clonic spasms or convulsions are usually present. In addition thereto there is vomiting, constipation, headache, opisthotonos, delirium, stupor, irregularity of the pulse, and later on in the disease, coma. In some cases paralysis is liable to occur.

Two Instructive Cases of Cerebral Pneumonia.

Case I.—Baby E., about 6 months old, a nursing baby, had this history: The child had been ill for several days, was restless and feverish, and had vomited. The stools were greenish and contained a large quantity of cheesy curds, in addition to mucus. The abdomen was slightly retracted, the extremities were cold; there was no edema present. The child did not seem to take the breast very well and vomited frequently after nursing. The temperature was 102⅘° F., per rectum, pulse 140, respiration 44. Unilateral spasms with twitchings of the muscles of the shoulder, arm, leg, and foot were constantly present. Twitchings of the muscles of the eye and a constant rolling of the eyeball were noticed; the head was thrown backward; the muscles of the neck were rather rigid, although there was no distinct opisthotonos. The spasms were confined to the right side of the body; the knee-jerk at the patella was absent on the right side; the plantar reflex on the right side was slightly present; the patellar reflex was normal on the left side and the plantar reflex was more distinct; the pupils responded very sluggishly and were unusually large; this dilatation of the pupils persisted through the whole illness, until convalescence was established. The examination of the thorax showed intense pulmonary congestion; there was slight resistance on percussion and marked dullness. Judging from the ratio between the pulse and the respiration, the diagnosis of pneumonia was hardly possible. The physical signs on auscultation showed bronchial breathing and a distinct crepitant râle. The diagnosis of cerebral pneumonia was made, although meningitis *per se* was excluded.

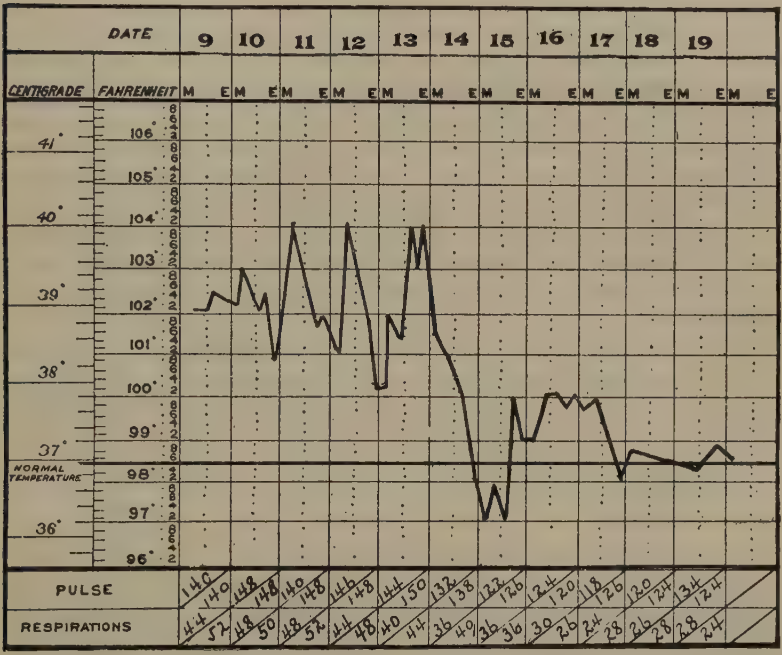


Fig. 137.—A case of cerebral pneumonia.

The treatment was directed to relieve the pneumonic infection. Expectorants, in addition to inhalations of steam, were ordered. Cold compresses were used as antipyretics, and castor oil or calomel was given to cleanse the gastrointestinal tract. The disease progressed; the temperature increased and rose to 103⅘° F. on the following day, and to 104⅖° F. on the third and fourth days. With the rise of temperature the pulse-rate was increased to 140, respirations to 52. On the fifth day of the disease there was a marked somnolence, stupor and partial coma. The head now showed a distinct opisthotonos; the sterno-cleido-mastoids were very rigid; the pupils were both dilated and the convulsions continued as before. Leeches were applied over the mastoid portion of the temporal bone to relieve the cerebral congestion; the scalp was shaved and iodoform collodion, 10 per cent., was painted on the occiput; ice-bags were applied over the whole of the cranium as well as to the nape of the neck; mustard foot-baths were frequently given and afforded some relief during the severe spasms. An enema consisting of chloral hydrate and sodium bromide, 5 grains each, with 1 ounce of starch water, was ordered. This was to be repeated every three hours until the spasms ceased. Before injecting the above drugs both the rectum and the colon were flushed with soap-water enema.

On the seventh day of the disease there was a distinct crisis, inasmuch as the temperature dropped from 104° to 97°, a drop of 7 degrees. (Fig. 137.) Stimulating expectorants were then ordered in the following manner:—

℞ Ammon. carb.	15 grains.
Syrup. pruni virgin	4 drams.
Aquæ camph. q. s. ad	2 ounces.

M. Half a teaspoonful every two hours.

The child's convalescence continued. The pneumonia completely subsided; resolution set in; the spasms, which had been so disagreeable and persistent, also stopped. The child commenced to show signs of consciousness, played, laughed, and cooed; the stools, which had been greenish and curdled, assumed a more natural yellowish color and pasty consistency. The appetite seemed to return; the infant nursed better, the nights were more comfortable, and the child slept from one feeding time until the next.

Case II.—Hannah T., 7 years old, was taken sick with fever, complained of being tired, and was very thirsty. She had anorexia and was inclined to constipation. She also complained of headaches. When first seen by me her temperature was 103.4° F. in the mouth, the pulse 168, respiration 34. She had a very coated tongue; the throat was dry; there were no patches visible. There was no history of exposure to contagious diseases; a gastric catarrh was suspected. The respiration and pulse ratio suggested a pulmonary complication.

The physical examination of the thorax gave no evidence of consolidation, merely roughened, harsh breathing, some rhonchi and slight resistance on percussing the right apex anteriorly. No diagnosis except "fever" was made. I ordered calomel 1 grain with powdered rhubarb 3 grains. Citrate of magnesia was given for the thirst. A fluid diet, consisting of equal parts of Seltzer and milk, with sponging of the chest with alcohol and water every hour, and cool cloths, moistened with evaporating lotions like bay rum or Florida water, to the forehead were also ordered.

I examined a specimen of urine and found nothing abnormal. On the following morning, twelve hours after my first visit, the temperature by rectum was 104.4° F., pulse 172, respiration 68. The bowels had been thoroughly cleaned, still there was no evidence of pneumonia, but the child seemed to be greatly depressed. There was marked apathy; the child was very restless but not awake. Constant twitchings of the muscles of the face and extremities occurred; the child cried out while in the stupor, refused food, attempted to bite and screamed loudly. The patellar reflexes were both present, the pupils reacted normally, the head was not retracted nor were the muscles rigid. There was no opisthotonos; the child could be roused by loud talking, or by being touched. The temperature in the evening was 106.2° F. by rectum, the pulse 124, respiration 40. One-drop doses of tincture of aconite were given every hour for eight hours and had no effect on the temperature, but did seem to reduce the pulse-rate and steady the heart's action.

The cold pack was ordered, to be renewed every half-hour until the temperature dropped to 102° F. Freshly prepared spiritus mindererus, ½ teaspoonful every half-hour until the temperature remained at 102° F., was also ordered. Warm mustard foot-baths were ordered to stimulate the circulation. No distinct evidences of pneumonia were obtained on auscultation or percussion.

The temperature continued to rise, until 106° F. was reached. Dry cups were applied over the posterior portion of the lungs; also an ice-cap to the head. Colon flushings with water at a temperature of 60° F. were also ordered, to be repeated every three hours. These seemed to have a very soothing effect on the nervous system. The child was much quieter after them and the temperature was gradually reduced.

Frequently after a cool tub bath, combined with a cold pack, the temperature dropped three to four degrees. (Fig. 138.)

The vital point in the treatment consisted in giving a supporting diet of eggs beaten up with sugar, concentrated soups, and milk predigested with peptonizing powder. Malt extract was given as a restorative and also for its diastasic effect. The treatment was continued until the child's temperature remained normal for several days, when all forms of creosote were discontinued.

It is interesting to note that very great depression of the nervous system, violent twitchings of the muscles, and talking aloud while asleep continued for several weeks after convalescence was established. The child slept at least twenty hours out of the twenty-four for fully one week. It was at times difficult to arouse her to take nourishment. This great stupor was evidently due to the profound toxemia which existed. The urine, which was frequently examined, showed an excess of phosphates, gave a strong diazo reaction, contained neither albumen nor sugar. The child was discharged after eight weeks and is in good health today.

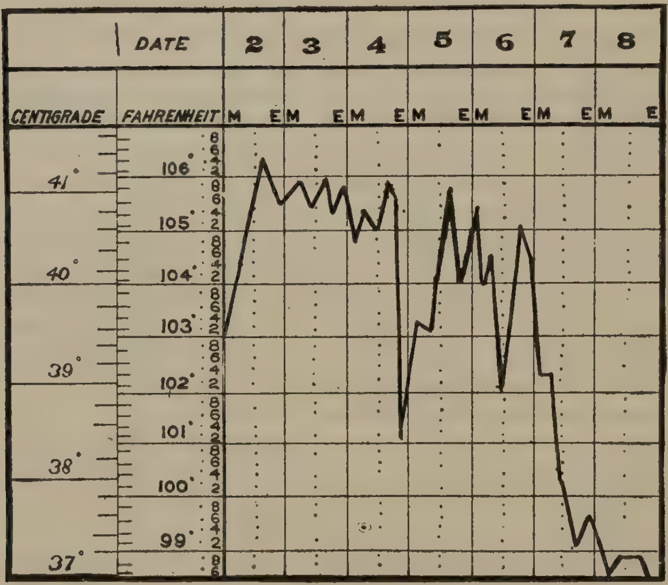


Fig. 138.—Cerebral pneumonia with high temperature and marked decrease in temperature after cold baths.

The following symptoms were the most noteworthy in the cases reported:—

(*a*) Unilateral spasms, twitchings of the muscles of the shoulder and the arm, and of the leg and foot, were constantly present. (*b*) Twitchings of the muscles of the eye and a constant rolling of the eyeball. (*c*) The head was thrown backward. (*d*) The patellar reflex was absent on the affected side. (*e*) The plantar reflex was slight on the affected side. (*f*) Distinct evidences of pneumonia, bronchial breathing and marked dullness on percussion. (*g*) Convulsions and marked stupor later in the disease. (*h*) When the crisis appeared in the pneumonia, the cerebral symptoms subsided. (*i*) Marked nervous depression and extreme hyperesthesia of the body, which continued for weeks after all inflammatory symptoms had subsided.

Schlesinger, in studying this disease, noted that it existed chiefly in children between the third and sixth years.

In acute apical pneumonia we usually note cerebral symptoms due to the irritation of the cervical ganglion. These symptoms subside with the crisis of pneumonia. They must not be confounded with meningitis, which is a distinct disease, although a frequent complication of pneumonia.

Diagnosis.—The diagnosis of pneumonia is easy when the physical symptoms of dullness on percussion, bronchial breathing, moist râles, and bronchophony are shown. These symptoms are not always present and are frequently absent during the first few days of the disease. The diagnosis can be made by the disturbed ratio between pulse and respiration, as previously noted. In addition thereto, the peculiar character of the respiration, added to the cough, will certainly aid in establishing the diagnosis. The vital point to remember is that, normally, bronchial breathing is heard posteriorly between the scapulæ and also in the regio supraspinata dextra. We must also remember that dullness on percussion appears somewhat higher on the right side posteriorly in the lower lobe than on the left side. The positive diagnosis can therefore only be made by noting the physical signs in the lungs and excluding the symptoms pointing to a gastric catarrh, to a typhoid fever or a meningitis.

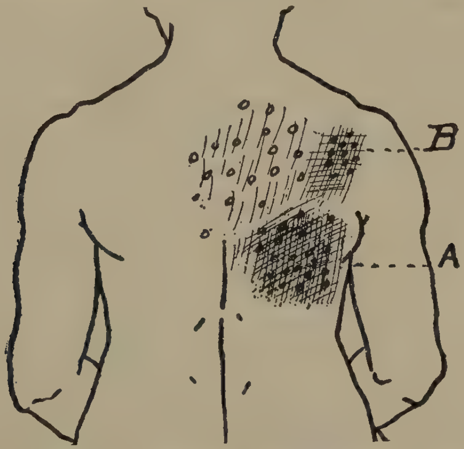


Fig. 139.—Pneumonia complicating diphtheria. *A*, Starting point of pneumonia, showing extent on third day. *B*, Focus whch developed three days after *A*, showing extent on third day of the new focus.

Atelectasis pulmonum can easily be differentiated from pneumonia by the absence of fever and by the marked difference in the dullness on percussion and usually by the absence of bronchial breathing. When fever recurs after it has apparently terminated, some complication must be suspected. Symptoms pointing to a pleuritic effusion are dullness on percussion and diminished respiratory murmur over the affected area. Gangrene of the lungs can usually be detected by the odor of the breath and the associated condition of collapse. If the condition assumes a chronic type and is associated with headache and fever, and if the child, in addition, commences to emaciate, then we may suspect the development of tuberculosis. To render such diagnosis positive, some of the sputum or expectoration should be examined for the presence of tubercle bacilli, the presence of which will establish the diagnosis. The absence of tubercle bacilli in the sputum does not necessarily mean that tuberculosis is absent.

The Prognosis.—The prognosis of croupous pneumonia is relatively good. Out of 173 cases reported by Baginsky, of Berlin, 4 per cent. died. These latter children were very poorly nourished.

Fatal cases may be expected in bottle-fed infants rather than in breast-fed infants. An abnormally developed thorax, so common in rickets, has an important bearing on the prognosis of this disease. Pigeon-breasted and narrow-chested infants, having an improperly developed lung space, are more prone to a fatal termination.

The development of symptoms of tuberculosis or abscess of the lung, or the extension of a pneumonia and the continuation of the same, will mean a depression of the heart's action and an inhibiting of the recuperative tendency. The vital point will be the question of nutrition. The greater the amount of food taken the better will be the chance for the patient's recovery; thus the maxim in treating a pneumonia, "Feed the stomach," is one that I have learned to indorse and verify.

Treatment.—The most important symptoms to be remembered in the treatment of this disease are the condition of the heart, the pulse-rate, the respirations, the temperature, and the condition of the kidneys, to be noted by the quantity and the quality of the urine secreted.

Isolate the Child.—As lobar pneumonia is an acute infectious disease caused by the invasion of the pneumococcus, it is communicable. Our first duty is to isolate. A case of pneumonia should be isolated as strictly as a case of diphtheria. All healthy persons should be excluded, be they friends or family. It is best to let them know that this disease can be disseminated.

In the treatment of pneumonia we must remember that toxemia and high temperature will produce degeneration of the muscle fibers of the heart, which, if prolonged, will result in heart-failure. Hence our treatment must be directed to lowering the temperature and to control the inflammatory process before stagnation of the blood and hepatization have taken place, thus aiming to retain the integrity of the respiratory tract.

A great many cases will get well without treatment. The disease simply runs its course, and if the patient is properly fed, and guarded, a favorable termination may be expected. On the other hand, there are certain symptoms which demand treatment. For example, hyperpyrexia will require treatment, especially so as the continuation of the same may be the means of developing disturbances resulting in convulsions. My preference has always been for the use of cold externally. If cyanosis exists then warm flaxseed poultices may be tried.

The sudden application of cold externally causes a deep inspiration and consequent forcing of air through the alveoli, thus preventing atelectasis. The air surrounding the child should be kept moist with steam from a teakettle having a long spout directed toward the child.

The following case illustrates:—

F. A., 5 years old, when first seen by me had a temperature of 99.5° F., respiration 36, pulse 120. Symptoms pointed towards gastric derangement—no positive diagnosis was possible. A light diet and a dram of rhubarb and soda was given three times a day. On the following day the temperature was 104⅗°, respirations 50, pulse 130. There was slight dullness over the right lung, posteriorly, bronchial breathing, slight cough, no expectoration. Diagnosis, pneumonia.

A tub bath of tepid water was given for three minutes, and repeated every three hours. The temperature dropped two degrees, sometimes three degrees after each tubbing. Liquid diet was given. Medication was given when necessary—no antipyretics—no stimulation. The bowels and bladder were watched. The case recovered.

In the above case true symptomatic treatment was carried out. The severe cough received an expectorant with an anodyne (codeine) when necessary to relieve pain. Diluted milk and whey was given every three hours. Broth and gruel was used as a variant. Cool water whenever thirsty.

Drug Treatment.—When high fever persists in a weakened child with very low resisting power, such fever must be reduced. The child's system must be carefully watched while fever is in progress. One child will tolerate a temperature of 105° F., laugh and play, and take its food regularly, while another child in a similar pulmonary condition will show extensive cerebral irritation, somnolence, tremor, twitching of the muscles, and possibly convulsions at a temperature of 103° or 104° F. In the latter instance it shows that the poison from the pneumococcus infection has overwhelmed the nerve centers governing heat production. When decided nervous or cerebral symptoms present themselves, a reduction of temperature is demanded, or we must not be surprised to see convulsions set in, with probably a fatal termination.

Antipyrine, phenacetin, salol, salipyrine, and quinine are among the more common antipyretic measures used as indicated, but, as they are cardiac depressants, must be cautiously prescribed. Tincture of aconite, in 1-minim doses, repeated every hour, has a remarkably good effect in this disease. In addition thereto, spirits of mindererus in half-teaspoonful doses, repeated every hour, will have a very good diaphoretic effect. Dover's powder will relieve cough and will also aid diaphoresis.

To relieve convulsions a hot tub bath to which several tablespoonfuls of mustard have been added is useful. The child should be kept in the bath at least several minutes, with constant friction over the body while in the bath. If the convulsions recur the bath may be repeated every twenty minutes. Five drops of chloroform may be inhaled from a handkerchief, immediately following the bath.

To relieve the cerebral hyperemia, calomel in $\frac{1}{10}$-grain doses, and increased, may be repeated until liquid stools have been produced. It is one of our most valuable remedies and should be used at the onset of a suspected pneumonia. Attention to the stomach and bowels will frequently be the means of saving the life of the patient. I insist upon a loose condition of the bowels, and if the same cannot be produced by the administration of calomel, then an enema should be given by flushing the colon as often as once in twelve hours to cleanse the parts. When children are old enough, then one of the most valuable remedies is to give copious drinks of citrate of magnesia. This will not only quench the thirst, but will act as a laxative, and in addition thereto stimulate the secretion of urine. We find, therefore, that the emunctories require especial stimulation and attention during the course of lobar pneumonia.

Sponge Baths.—The surface of the body should be sponged with tepid water every day. Equal parts of alcohol and water are soothing to the patient, and should be used every hour if the temperature requires it.

When the fever reaches 104°, 105° or 106° F., and the child is restless and twitches, the pyrexia is irritating the central nervous system so that convulsions may follow. If there is no exanthematous eruption such as scarlet fever or measles then a tub bath will not only relieve fever, but quiet the child and produce sleep.

The child should be immersed in a tub of warm water at a temperature of 100° and allowed to remain in the bath three minutes. A little cold water may be added from time to time until the temperature is lowered to 95°. During the bath the child should be rubbed over the front and back of chest to aid the circulation. Such tubbing usually reduces the temperature one or two degrees within twenty minutes, and quiets the central nervous system. These baths may be repeated once every three hours if the temperature reaches its former height. With proper care against draughts in the room and useless exposure, the warm tub as above outlined is far preferable to sponging and has a much more soothing effect.

Serological Treatment of Pneumonia.—This method of combating pneumonia has recently come into general use with some degree of success. Specific sera have been discovered for pneumococci of Types I, II, and III, but none has been found satisfactory for Type IV, due to the fact that this group is composed of more than one organism. The method used in determining which serum to inject is briefly as follows: The patient's mouth is washed out and subsequently a sample of sputum is collected. This is ground up in salt solution and injected into the peritoneal cavity of a mouse. The mouse dies in twenty-four hours and its peritoneal cavity is filled with exudate. This exudate is then tested for agglutination with organisms of Types I, II, and III. The organism which agglutinates the serum is the one causing the pneumonia. Antibacterial serum previously prepared is then given to the patient; the serum used depending upon which organism has been found to be the causative agent.

In New York, beneficial results have been obtained only with Type I serum. The other sera have not as yet been developed sufficiently to warrant confidence in them.

Hygienic Treatment.—Room Temperature: One of the most important factors is the regulation of the temperature of the room. Every child having a pneumonia should be put into a room having a temperature of 65° to 70° F. An equable temperature should be maintained, as the same is very grateful during the febrile stage of this disease. Fresh air should always be admitted.

Oxygen.—When severe dyspnea occurs and if cyanosis exists, then oxygen inhalations may be required. Under these conditions several respirations should be given every few minutes until the lips lose their cyanotic appearance and again have their natural color.

Another valuable means of reducing the temperature is by sponging every hour with acetic ether. This must be cautiously used, owing to its volatile and inflammable tendencies.

The Oil-silk Jacket.—This jacket is valuable when we desire a diaphoretic effect. It also prevents the chilling of the surface of the lung by maintaining a uniform temperature. The details of making this jacket can be found in the article on Bronchopneumonia, page 507.

Dietetic Treatment.—As previously stated, the prognosis in this condition depends on the amount of food the patient will take. A milk diet should be prescribed. Buttermilk, zoolak, rice and milk, farina and milk, oatmeal and milk, and cold foods, such as cornstarch pudding, rice pudding, and tapioca pudding, are indicated. If the child is very thirsty, ice cream may be permitted very sparingly. Cold water should be given frequently. Concentrated soups, chicken broth, and veal broth may be permitted. So also calf's foot jelly, chicken jelly, albumin in the form of raw white of egg, to which some sugar is added, may be given. A soft boiled egg or raw yolk of egg with sugar may also be given.

The interval between each feeding must be prolonged, owing to the subnormal condition of the digestive tract. If children are fed from the bottle, or if they are nursing babies, then they should be fed at a longer interval than previous to the time of this illness; for example, if the infant has been given the breast every three hours, it is a good rule to extend the nursing time to three and one-half or four hours, if it is possible. In this manner we will not only aid in the assimilation of the food, but frequently prevent stagnation of milk which had been previously taken.

Night Feeding.—The rule which governs the feeding of healthy children cannot be applied to children suffering with pneumonia. During the febrile stage large quantities of liquids are demanded. In order to overcome the cardiac depression good nourishment is indicated. A nursling suffering with pneumonia should be given the breast several times during the night. Bottle-fed infants may also receive some nutrition every three or four hours during the night. A favorable termination in this disease can only be expected when the lowered vitality is stimulated by nutrition.

Pneumonia Gastrica.—This form of the disease is one in which the symptoms of vomiting and diarrhea predominate, and hence it is known as the gastric type of pneumonia. While the lungs will show the usual symptoms of a croupous pneumonia, the tongue, stomach, and bowels will present symptoms of an intense inflammatory condition of the digestive tract. Not infrequently jaundice may be present.

The conjunctival mucous membrane may be pigmented from the presence of bile. The secretions may also show biliary pigmentation. Herpes may appear on the upper lip, thus showing that there is an intense inflammatory condition affecting primarily the digestive tract.

Wandering Pneumonia ("Pneumonia Migrans").—This form of pneumonia is met with quite frequently. The symptoms are those common to lobar pneumonia, as chills, fever, and the usual physical symptoms of a consolidated lung in this condition. The name is derived from its tendency to spread from lobe to lobe. The infection usually commences in one lobe and spreads to the second, to the third, and frequently when the crisis has taken place the disease commences with full force in another lobe and may continue so for several weeks. That this form of pneumonia is very serious can be easily imagined. A child, having suffered with acute lobar pneumonia and passed its crisis with an already weakened heart, has again to pass through the second pneumonia and frequently through a third and a fourth, and must have great vitality in order to recover from the depression caused thereby.

Pleuropneumonia.—It is rare to find lobar pneumonia without an associated inflammation of the pulmonary pleura. Not infrequently with a severe type of bronchopneumonia covering large areas of consolidation there is a coexisting inflammation of the pleura. It is difficult to state at times which lesion began first, whether it was the pleurisy or the pneumonia, in a given case of pleuropneumonia.

TUBERCULOUS PNEUMONIA.

There are four pathological conditions which illustrate the various stages of the disease; they are: First, a bronchitis with rhonchi scattered through the chest; second, small areas of consolidation; third, complete consolidation with bronchial breathing, dull areas on percussion; fourth, excavation with cavernous or amphoric breathing.

In its early stages the disease resembles bronchopneumonia.

Cavities are frequently found post-mortem. They are difficult to find in children under 3 years of age. On the other hand, children over 8 or 9 years have cavities which can be recognized as early as in the adult.

Holt states that the reason why in infancy cavities are so seldom recognized during life, is because they are generally small, often centrally located, nearly always filled with thick pus or cheesy matter, and rarely communicate freely with the bronchi. On the other hand, it is very common to find signs in young children which, if heard in adults, would be regarded as almost positive evidence of a cavity although none is present. These signs are cracked-pot resonance and cavernous breathing. They are not usually due to bronchiectasis, since this condition belongs to chronic cases, and especially to older children, but most frequently to consolidation about a large bronchus superficially situated, *viz.:* below the clavicle, high in the axilla, and in the interscapular region. The wide area over which this bronchocavernous breathing is heard is one of the most striking points of difference from the signs of a cavity.

Course.—There are two types of cases: First, rapid cases or those terminating very quickly; second, those assuming a chronic course (protracted cases).

1. *The Rapid Type.*—The pathological process is a bronchitis affecting the smaller tubes surrounded by areas of consolidation.

These lesions are the same as are found in bronchopneumonia. The temperature curve is frequently the same as found in bronchopneumonia, ranging between 100° and 104° F. The areas of consolidation are more frequently found in the upper lobes. There is also bronchovesicular breathing and bronchophony. Percussion note shows slight dullness. The cough may assume a paroxysmal character similar to whooping-cough. Convulsions and frequently meningeal symptoms, such as a slowness of the pulse or Cheyne-Stokes breathing, will show the extension of the disease to the brain.

2. *Those Assuming a Chronic or Protracted Course.*—The duration of this form of the disease may be between one and six months. Some cases may last but three months. This is the most common type of the disease seen. Cases are frequently seen following measles, whooping-cough, pneumonia, or diphtheria. Those cases I have seen ended fatally within three or four months. There is usually a slight improvement after the second or third week of this disease. The temperature falls and the physical signs seem to disappear. As a rule the disease reappears with more violent symptoms, and emaciation, fever, and sweating continue until the end. The temperature curve is not regular. In some cases it ranges between 99° and 101° F. Other cases will have a much higher temperature, the thermometer registering 104° F. frequently. Expectoration is rarely seen in young infants, as they invariably cough and swallow the sputum. The breathing is usually labored; hence dyspnea is almost always present. When we have Cheyne-Stokes breathing, or irregular breathing, with a slow pulse, then cerebral complication should be suspected.

CHRONIC PULMONARY TUBERCULOSIS (TUBERCULOUS BRONCHOPNEUMONIA).

This condition is rarely found in infants and very young children. When chronic pulmonary tuberculosis is noted it is usually seen in children after the sixth or eighth year.

Pathology.—Osler states that small cavities are by no means rare in chronic pulmonary tuberculosis of children, but very large excavations are rare; thus in 265 cases noted by Barthez and Sanné there were 77 cases with excavation, chiefly in the upper lobes. In the analysis by Leroux of the cases of the late Parrot, in 219 children under 2 years of age, there were 57 instances in which cavities existed. In five of these the children were under three months. In long-standing cases hard, firm, fibrous tubercles are found, and sometimes cutaneous nodules. The primary lesion in a great majority of instances is a tuberculous bronchopneumonia, taking its origin in the smaller bronchioles, leading to peribronchial nodules and subsequent peribronchial alveolitis. The lesions are similar to those met with in tuberculosis of adults—miliary tubercles, peribronchial nodules,

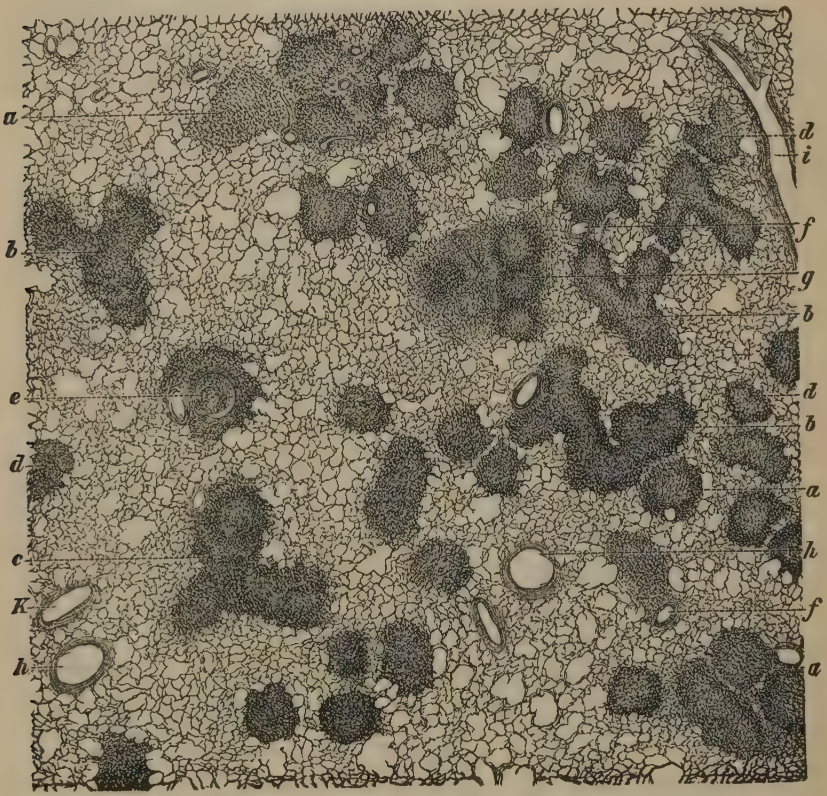


Fig. 140.—Chronic nodular tuberculous bronchopneumonia. (*a, b, c, d*) Tuberculous foci of variable size and shape, corresponding to the infiltrated alveolar system; (*e*) transverse section through an infiltrated occluded bronchiole; (*f*) small arterial branch; (*g*) group of nodules undergoing coalescence; (*h*) small unaltered bronchus. (*k*) artery. × 6. (*Ziegler.*)

caseous blocks, areas of softening and of fibroid induration, and cavities of various sizes. We do not see so frequently the invasion of the lung from the apex downward. The chief seat of disease may be in the central portion of the lung, or even at the base. In tuberculosis of the lymph glands the groups along the trachea and about the bronchi may be greatly enlarged and caseous, forming on section a very striking feature in the chronic pulmonary tuberculosis of children.

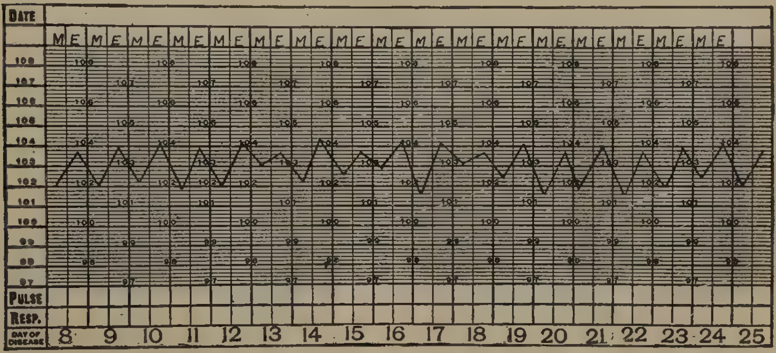


Fig. 141.—Fever curve during the early period of chronic pulmonary tuberculosis. The daily excursions are slight, and generally range between 102° and 104° F.

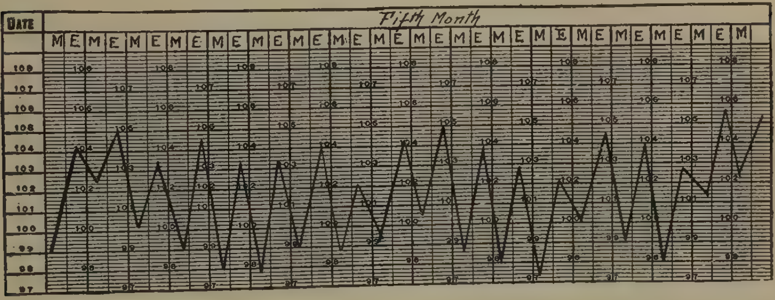


Fig. 142.—Temperature curve during the fifth month, when the disease is more extended and softening has taken place with the formation of cavities. The temperature is more hectic in character. The morning temperature may be normal or subnormal, while the evening temperature ranges between 103° and 105° F.

Symptoms.—Chronic pulmonary tuberculosis in the child presents the same symptoms as in the adult. Usually a bronchopneumonia will first be encountered, or the symptoms present will resemble those of a bronchopneumonia. When fever persists and there are evidences of a general breakdown, such as malaise, loss of appetite, and emaciation with or without cough, then this condition must be suspected. When these children expectorate, the same resembles that seen in adults. Tubercle bacilli have frequently been found in the expectoration of cases under my care. Blood spitting in which the mucus is blood-stained has been seen by me. The blood is bright red in color. Epistaxis is sometimes seen during the course of the disease. The temperature ranges between 100° and 102° F. in the beginning of the disease; later on it assumes the real hectic character; thus, the temperature may be 99° to 100° F. in the morning, and 103° to 105° F. in the evening.

Pleuritic pains are complained of in various parts of the chest. There is marked dyspnea and frequently cyanosis. Osler states that some cases do not have any pain throughout the course of the disease. A general emaciation associated with muscular weakness and anemia is usually seen later in the disease. Tubercular ulceration of the intestine will frequently cause diarrhea. In a child seen by me with chronic tuberculosis of the lungs, a general anasarca was present.

Katie B., 8 years old, had been a very delicate child. She was breast- and bottle- fed, and lived in a tenement house.

Family 'History.—The father was a drunkard and did not support his family; the mother is a frail, anemic woman, although no evidence of pulmonary disease could be found. The child was late in walking, late in teething, and late in talking. Distinct evidence of rickets of the bones was everywhere noted. When 4 years old the child had measles, complicated with bronchopneumonia, after which a cough remained. Three months after the measles the child still coughed and showed evidences of malnutrition. The cough persisted in spite of codliver oil, malt extract, and iron, which were liberally given. As the family was poor, they could not take the child to the country for a complete change of air. I did not see the case again for two years. At this time she had a cavity at the apex of the right lung, was terribly emaciated, and complained of pain on breathing and suffered with marked dyspnea. Pleuritic friction sounds were heard over small areas of the chest on both sides. The child had hemoptysis, besides a purulent expectoration. Tubercle bacilli were found in the sputum. She died after a violent hemorrhage, from exhaustion and heart-failure.

The treatment is the same as described for acute tuberculosis.

PULMONARY GANGRENE.

This condition, fortunately, is very rare.

Diagnosis.—This is made by the characteristic foul odor of the breath and the expectorated gangrenous material. I have seen a case of this kind during my service at the Willard Parker Hospital in a child that suffered with laryngeal diphtheria complicated by bronchopneumonia. The septic condition dragged on for weeks. There was a very putrid odor to the breath. The child finally died of sepsis. As a rule the diagnosis can only be made post-mortem.

Treatment.—Restorative treatment, consisting of a light nutritious diet, should be given and stimulants liberally used. Steam inhalations impregnated with beechwood creosote will modify the odor. Creosote carbonate can be given with the food in 5- to 10- minim doses, several times a day.

ACUTE TUBERCULOSIS (MILIARY TUBERCULOSIS).*

Tuberculosis is a specific infectious disease caused by invasion of the tubercle bacillus. The disease is disseminated by the same.

Etiology.—Acute miliary tuberculosis is frequently seen in very young children. I have seen cases in bottle-fed infants under 1 year of age. It is also frequently associated with tubercular meningitis. As a rule it follows those diseases which devitalize the system, such as the acute infectious diseases. In prolonged diseases affecting the air passages, tuberculosis frequently follows.

Cows' Milk.—Before the days of pasteurization tuberculosis was often found in infants as the direct result of tubercle bacilli ingested in the milk. When the milk was boiled such infection did not take place. Today, with pasteurization or boiling of milk, this mode of origin of tuberculosis in infants is rare. It is difficult to prove when tuberculosis is found in infants fed on cows' milk that the disease was caused by bacilli in the milk. It is generally believed that when tuberculosis is found in the intestinal nodes that the etiological factor was not the milk, but swallowed sputum.

Human Milk.—Human milk is intended by nature for the nutrition of infants. It offers decided prophylactic substances to the nurslings, for example: The nursing infant is very rarely affected with diphtheria or similar infectious diseases. This is most probably due to the immunity conferred by human serum and the antibodies or bacteriolysins which the serum contains during the nursing period. This also accounts for the rarity of pulmonary tuberculosis in children reared on human milk.

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* Tuberculosis of the bones, joints, and glands are described under separate articles.

Some years ago, I examined five thousand children at random for the presence of tubercular lesions. More than 4900 cases out of this number showed no sign of pulmonary disease; 1700 of these cases suffered with adenoids, pharyngeal disease, catarrh of the nasopharyngeal tract, or infectious conditions due to poor ventilation and general unsanitary surroundings. The cases were taken in children from the first to the tenth year inclusive; 59 cases out of this whole number showed distinct evidence of pulmonary tuberculosis. Only 9 cases of this whole number showed the presence of tubercle bacilli in the sputum. The difficulty in procuring sputum was an obstacle in making more frequent examinations. Forty-three cases of this number had bone and joint tuberculosis in addition to evidences in the lungs. In two cases tubercular empyema was found. Five of these 59 cases had Pott's disease.

Table No. 40.—Showing Manner of Feeding in 59 Consecutive Cases of Tuberculosis.

Manner of Feeding.	*Number of Cases.*
Breast milk (human milk)	2
Cows' milk	37
Condensed milk	18

Tuberculosis in children is so closely allied to scrofulosis that a great many authors believe them to be identical. There certainly are a great many characteristics common to both. On the other hand a close scrutiny of the pathology of the disease will show them to be distinctly separate. That scrofulosis will frequently be the medium through which, later on, tuberculosis develops, is well known and recognized.

In the tuberculosis of the new-born evidence shows that the maternal ovum may be infected from the mother, or by the paternal seminal fluid; later the embryo may be infected by the placental route or amniotic fluid when the mother is tubercular. These modes of infection, while theoretically possible and occasionally actually authenticated are nevertheless extremely infrequent in practice. By whichever of the above-mentioned routes the bacillus has gained entrance to the fetal organism, there is no doubt that it may invade it and remain latent therein for an indefinite period. Unless the bacilli are actually found within the tissues, it is extremely difficult to uphold the view that the infection has not been acquired after birth.

The transmissibility of tuberculosis by means of drinking milk from cows whose udders are tuberculous, is well known.

Behring believes that milk infection remains latent for years and then develops tuberculosis. This he states accounts for the absence of the disease in very young infants.

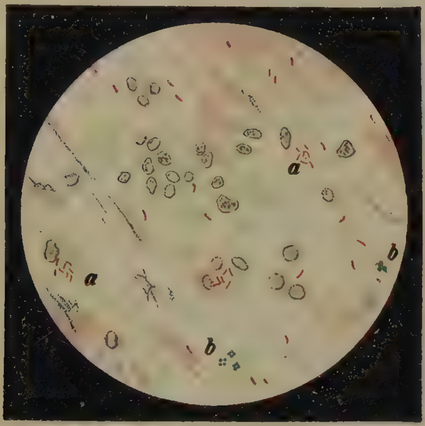

Fig. 143.—Tubercle bacilli and micrococcus tetragenus (sputum). Gabbet's stain, Leitz ocular I, oil immersion 1/12. (*a*) tubercle bacilli; (*b*) micrococcus tetragenus. (*Lenhartz-Brooks.*)

Westenhoeffer believes that caries of the teeth and inflamed gums, as seen during dentition, permit the invasion of the tubercle bacillus into the lymph channels of the neck, resulting in cervical, bronchial, retrosternal, tracheo-bronchial, and finally mesenteric tuberculosis.[1]

Chiari and Freudenthal believe that the retropharynx which harbors adenoids is the point of entrance of the tubercle infection. *This view has always been held by me, inasmuch as tubercular meningitis results most probably from an extension upward from the pharynx,* and downward. The infection enters through the cervical glands.

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[1] Berlin Klin. Woch., February 15, 1904.

Contact of the delicate, perhaps abraded, skin or mucous membrane of the young infant with tuberculous sputum may result in inoculation, as has been repeatedly shown in connection with ritual circumcision.

The interesting observations of Lehmann show that sucking the wound after the ritual circumcision of Jewish children has caused tuberculosis. Baginsky reports a case of the transmission of tuberculosis to the eyebrow of a child by a tuberculous person. Tuberculosis may be transmitted by the process of vaccination on the arm.

There must be a certain predisposition to the development of this disease. Other factors which are prominent in this connection are poor hygienic conditions; rooms in which sunshine is absent and in which foul air stagnates will lower the normal resisting power of any and all individuals. When a child has passed through an acute infectious disease which has already lowered its vitality, then an infection with tuberculosis is more easily acquired. Among such diseases which predispose to the development of tuberculosis are whooping-cough and measles. The same is also true in exhaustive diseases which drain the vitality of children for a long time, as, for example, after a prolonged attack of summer complaint.

Tuberculosis has so great a tendency to generalize itself in children that the question of the primary infection is not to be settled by the mere frequency of the lesions. The fact that children swallow their sputa is to be kept in mind. There is no question as to its infectiousness, while that of infected milk in the human species has not been absolutely demonstrated. Still's statistics show that in 25 cases taken consecutively, of children under 3 years, who did not expectorate, intestinal lesions were found in 19, while in a similar series, aged between 3 and 12, they were found in only ten. It would thus appear that autoinfection by the sputa in infants is a matter of serious importance.

Bacteriology.—The tubercle bacillus travels chiefly by means of the lymph stream. Some investigators report its presence in the blood.

Demme found this specific organism in pus exuding from an eczema; the same is true about pus in otitis. Tuberculous affections of the tongue, of the nasal mucous membrane, of the thorax and tuberculous swellings on the lips of young girls have been described by Volkmann. Primary tuberculosis of the thymus,

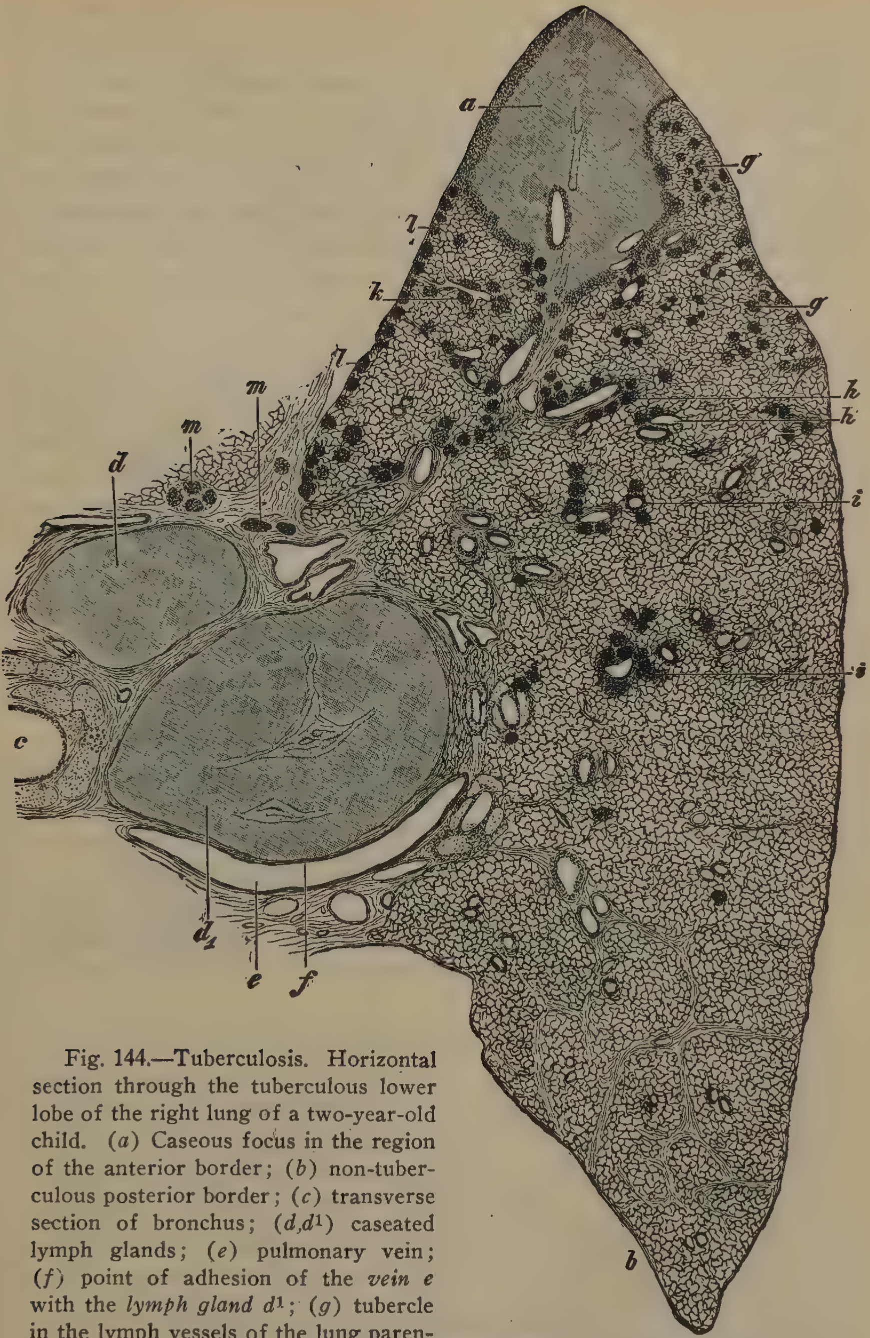

Fig. 144.—Tuberculosis. Horizontal section through the tuberculous lower lobe of the right lung of a two-year-old child. (*a*) Caseous focus in the region of the anterior border; (*b*) non-tuberculous posterior border; (*c*) transverse section of bronchus; (*d*,*d*¹) caseated lymph glands; (*e*) pulmonary vein; (*f*) point of adhesion of the *vein e* with the *lymph gland d*¹; (*g*) tubercle in the lymph vessels of the lung parenchyma; (*h*) periarterial; (*j*) peribronchial; (*k*) perivenous tubercles; (*l*) lymph vessel tubercles of the pleura; (*m*) tubercle in its connective tissue of the hilus of the lung. × 3. (*Ziegler.*)

of the heart, and of the vaginal mucous membrane have been published by Demme. A. Baginsky has described a series of cases of tuberculous perityphlitis, peritonitis, and enteritis. Tuberculosis of the testicles in children has been seen and observed by him. The internal organs suffer from the invasion of the tubercle bacillus in this connection. The lungs and the pleura, the pericardium and myocardium, the liver, spleen, and kidneys; the coverings of the brain, and the brain itself are frequently affected.

The question of the transmission of the tubercle bacillus is one that is still debatable. Thus Jani reports in Virchow's Archiv, Bd. 103, p. 522, that the seminal fluid of tuberculous persons contains tubercle bacilli. The cases of tubercles in the fetus are described by Johne and Armanni.[1] Bang, Lehmann, Birch Hirschfeld, Rindfleisch, and Kossel are among those who have reported isolated cases of tuberculosis directly transmitted from parent to child. Hochsinger reported 3 cases which he described as congenital tuberculosis. These cases were associated with syphilis, and he believes that this disease is far more frequently transmitted than is generally recognized. Thus it appears from the studies of Brandenberg, Lesage, and Wolff that the placenta is an exceedingly valuable culture medium for this specific micro-organism, and thus they account for the comparative freedom of the fetus born to a tuberculous mother.

Cornet and Flügge made extensive investigations showing the means of dissemination of the tubercle bacillus. We are indebted to them for our knowledge regarding the danger of sputum of a phthisical patient, and also regarding the manner of transmission of this disease.

How susceptible very young children are can be shown by a case published by Wassermann,[2] in which he reports the transmission of tuberculosis to a child six weeks old by being in contact in the same room with a phthisical patient for eight days. Kitasato reports the fact that tubercle bacilli die rapidly in the sputum, and he therefore does not believe that the danger of the transmissibility of tuberculosis is as great as has been claimed. That contact with tuberculous patients is nevertheless a very serious matter can be seen by a study of the literature.

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[1] Tenth International Medical Congress, Bd. 5.

[2] Zeitschrift f. Hygiene, p. 353.

Human milk has been closely studied and the possibility of infection through this channel cannot be denied.

Pathological Anatomy.—We are indebted to Bayle, Buhl, Laënnec, and Virchow for the division and study of the pathological anatomy of this disease. These authors divide the conditions into two distinct parts: First, cheesy pneumonia; second, the real miliary tuberculosis. By the cheesy pneumonia is meant that form of a chronic destructive process ending in cheesy necrobiosis. By the miliary tuberculosis is meant that form of disease commencing as a tiny nodular swelling, which starts in the connective tissue and is associated with the lymph

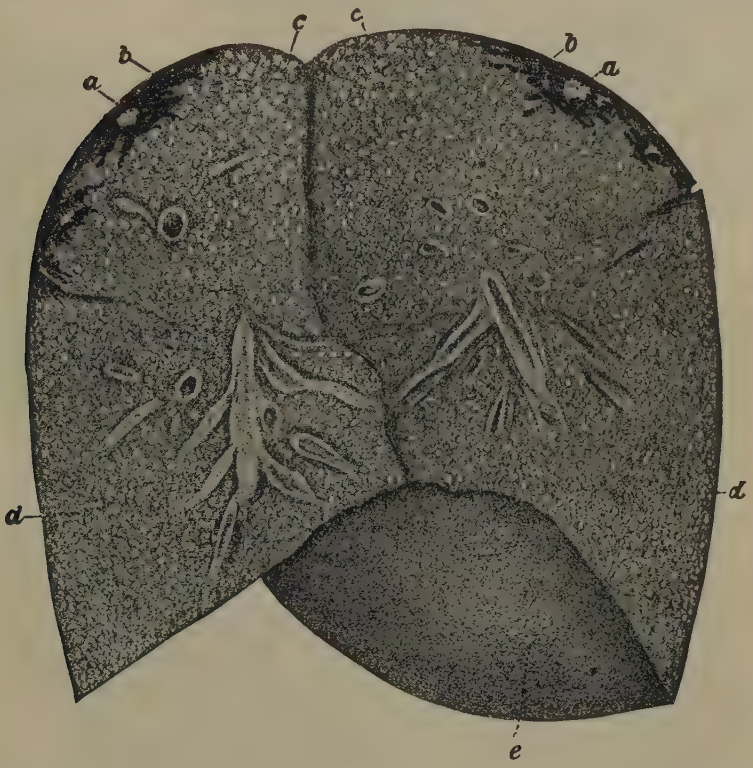

Fig. 145.—Acute pulmonary miliary tuberculosis (cut surface of the lung). (*a*) So-called obsolete tubercle (old encapsulated caseous focus). (*b*) Induration. (*c*) Caseous, partly agminated nodules (transverse section of caseous bronchi). (*d*) Submiliary non-caseated tubercle in the true lung tissue. (*e*) Tubercle of the pulmonary pleura. One half natural size. (*Langerhans.*)

bodies, having a tendency to form broken-down cheesy masses. The pathology of this disease can certainly be associated with no greater name than that of Virchow, to whom we are indebted for the bulk of our knowledge of this disease.

The tubercle is a small, grayish-white, translucent, sometimes yellowish body. The greatest masses consist of small, round cells about the size of a red blood-corpuscle, and large cells resembling epithelium. There are also giant cells. The giant cell, as a rule, can be found in the middle of these tubercles and is so closely identified with this condition that it has been looked upon as characteristic of this disease.

The growth of the tubercle consists in the development of new masses arising from the fixed tissue cells. In tubercles there are no blood-vessels, and as there is no nutrition they easily break down and form what is later on the beginning of cheesy masses, which, by absorption and a melting process, are the real beginnings of cavities. At times these masses become calcified. The question of the specific origin of the disease has been finally settled by the investigations of Koch, who proved the specific micro-organism known as the tubercle bacillus to be the pathological factor.

Biedert found 16 cases of primary intestinal tuberculosis among 3104 post-mortems.

Heller found 7.4 per cent. of primary tuberculosis among 714 post-mortems in diphtheria, and a total of 19.6 per cent. of all varieties of tuberculosis among these 714 cases.

Orth states that primary intestinal tuberculosis is exceedingly rare in Berlin because of the universal use of sterilized or boiled milk.[1]

Baginsky reports that he found 8 cases of tuberculosis that died among 871 nurslings at his Berlin hospital. These were all under ten months of age. On the other hand he found, among 266 children in the second year, 13 died of miliary tuberculosis. One hundred and eighty-two children out of 611 died of miliary tuberculosis between the age of 2 and 4 years. Out of 152 children examined between the ages of 4 and 6 years, 6 had miliary tuberculosis.

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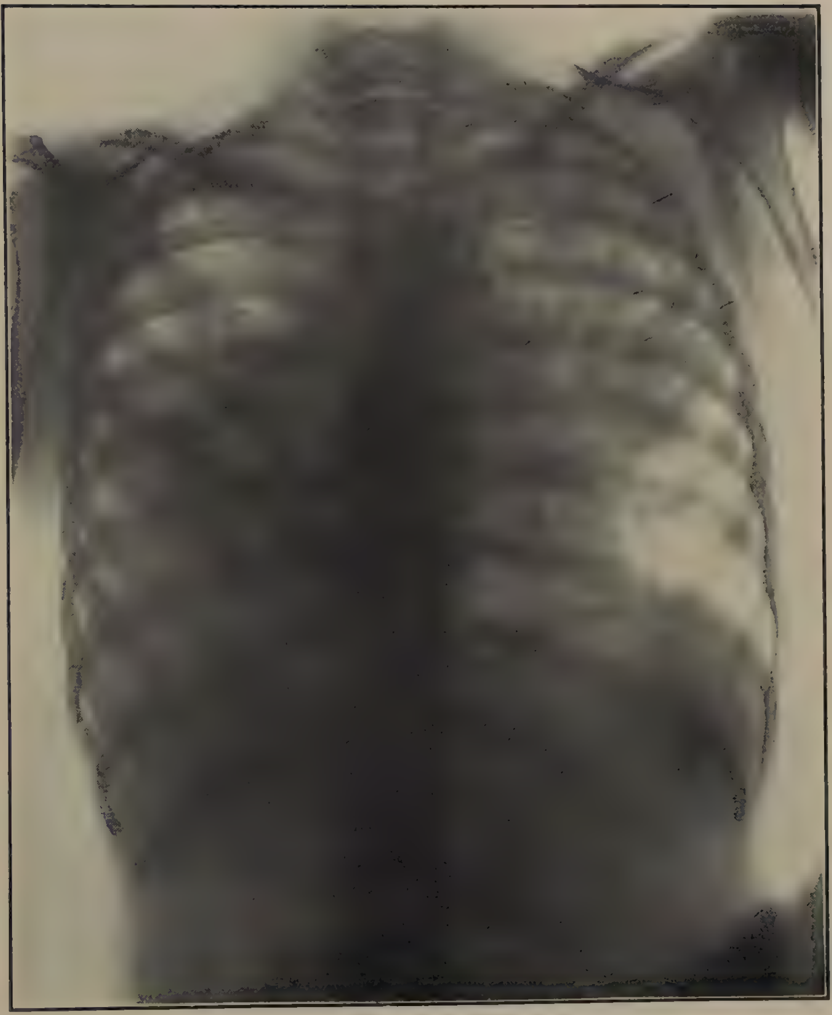
[1] I have collected and described a series of important observations on the association of cows' milk with tuberculosis. The pathology of the cows' udder and the milk ducts are also described. (See chapter on Cows' Milk.)

PLATE XXXII



Disseminated pulmonary tuberculosis with collapsed right lung and a natural pneumothorax. Child four years old.

Still[1] considers these facts and offers some interesting statistics, based, not on clinical observation, but on post-mortem findings, for the solution of this problem. In 769 autopsies of children, tubercle was found in 269, or 35.2 per cent. Tuberculosis was the actual cause of deaths in 252, or 32.8 per cent. From these statistics, therefore, it can be roughly estimated that about one-third of the deaths in childhood are due to tuberculosis in one form or other. While children are thus shown to be specially subject to this disease, they are not equally so at all ages, for Still shows that up to the age of 4 the percentage is as high as 71, and between 4 and 8 is still 22.5; after 8 it diminishes to 6.5. Moreover, the greater part of the tuberculosis under the age of 4—43.4 of the 71 per cent.—occurred in children under 2 years of age.

This great frequency of tuberculosis in infancy has been used as an argument in favor of the idea of infection through milk, the primary lesion being in the digestive tract. It is true, Still says, that intestinal tuberculosis is exceedingly common in children; it existed in 52 per cent. of his cases examined, but so also is that of the brain and meninges—48 per cent.— and that of the lungs is far more frequent—78 per cent.

The total number of deaths reported as due to consumption in the United States during one year was 109,750, of which 53,626 were males and 56,124 were females and the ratio of deaths from this disease to 1000 deaths from all known causes was 109.9. In 1890 the corresponding ratio was 122.3.

The death rate of the colored from consumption was nearly three times that of the whites, and that of the foreign whites was much higher than that of the native whites. For the last-mentioned class the death rate for those having one or both parents foreign was also much higher than for those of native parents.

The death rate of males from this disease was considerably higher than that of females.

The total number of deaths reported as due to consumption in the United States in children under 15 years of age, during ten years was 8051, of which 3554 were males and 4497 were females.

The death rate from consumption in the registration States was higher in the District of Columbia (305.3), which was due mainly to the large colored population. The next highest rate in the registration States was in Rhode Island, where it was 195.3. The death rate from this disease was higher among males than females in the cities, but lower in the rural districts. Excluding the District of Columbia, the highest occurred among males in the city of New York (265.3), and the lowest among males in the rural districts of Michigan.

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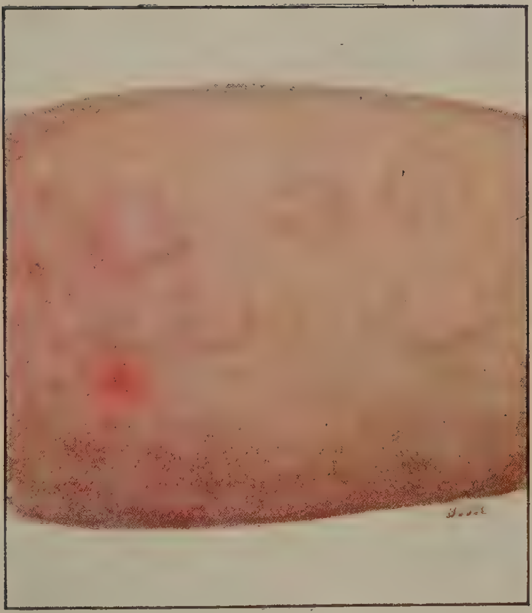
[1] Clinical Journal, London.

The following table shows that the death rates due to consumption in white persons under 15 years of age were highest in those whose mothers were born in Italy (50.7), in France (47.1), and in "other foreign" countries (45.9); and were lowest in those whose mothers were born in Poland (11.4), in Bohemia (13.2), and in Germany (26.6).

J. Walker Carr reports statistics of necropsies on tuberculous children at the Victoria Hospital. He found 79 in which the disease most probably started in the chest and 20 in which it seemed to have begun in the abdomen. Here the relation between the two forms of infection is as 1 to 4. In 26 children of early or limited tuberculosis, the thorax alone was affected in 12 cases, the abdomen in 7, being in the proportion of 1 to 1.7. Of 53 tuberculous children under 2 years of age the disease most probably began in the chest in 43 and in only 5 certainly in the abdomen, the proportion in this case being as 1 to 8.6. Out of 27 children over 5 years of age, the disease began in the chest in 12, in the abdomen in 6, the relation being as 1 to 2.

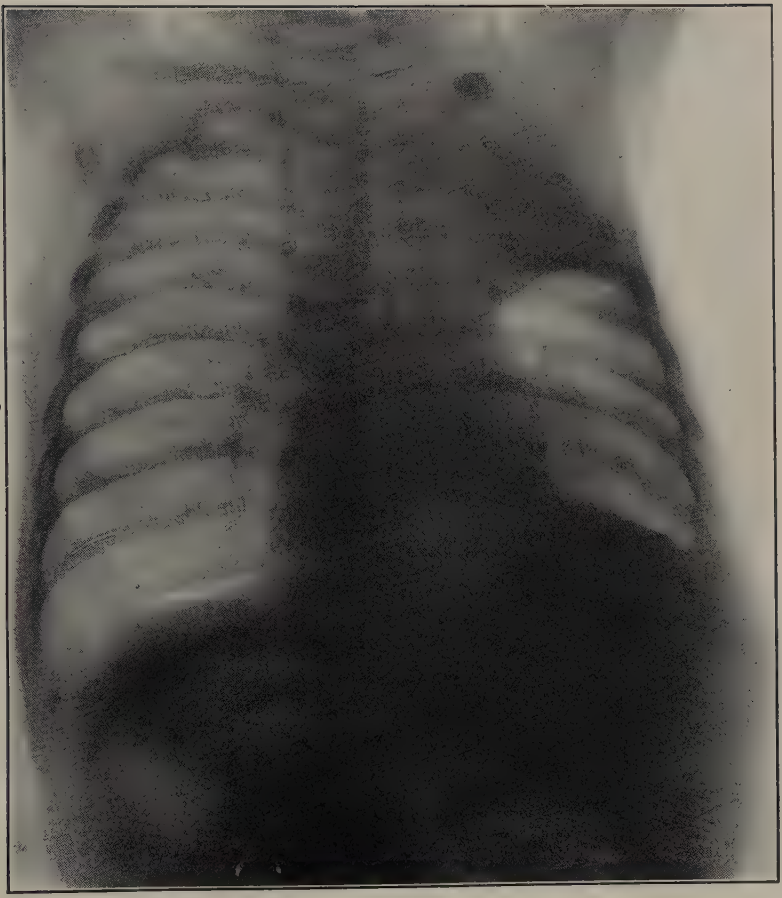
Symptoms and Diagnosis.—The more important symptoms noted in this condition are a general restlessness with a rise of temperature. Children frequently have little or no cough, but some difficulty with respiration for which no distinct physical signs can be found. The temperature will sometimes rise as high as 103° or 104° F., or it may suddenly become apyretic and assume a subnormal tendency. The temperature usually seen is 101° F. The children appear very anemic and at times cyanotic, mostly on the cheeks and lips. Emaciation usually accompanies this *"intermittent type of fever."* To the inexperienced, the beginning of a miliary tuberculosis resembles mostly the clinical picture which so frequently accompanies intermittent fever. There usually is slight swelling of the peripheral lymph glands. The spleen and liver will be felt enlarged. The urine will give a slight diazo reaction, also an indican reaction. Neither of these, however, are constantly present. We have what is commonly known as a "pre-tubercular anemia," in which there is a general *tendency to breakdown,* and

PLATE XXXIII



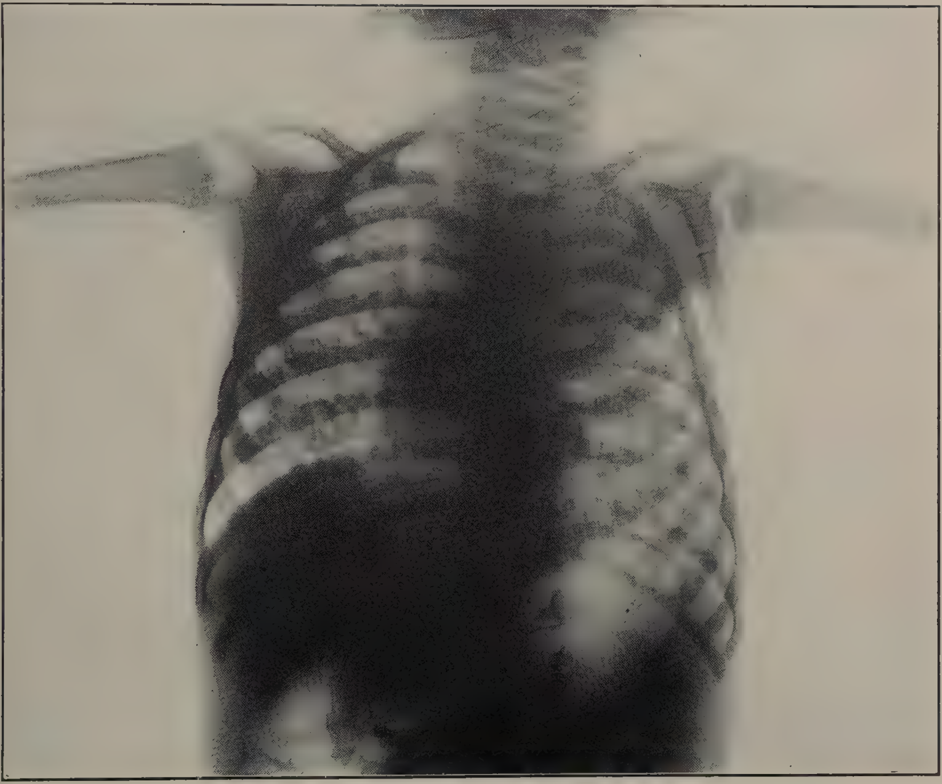
Papulo-necrotic tuberculides in a child two years old, seen during my service at the Willard Parker Hospital. A valuable diagnostic lesion of the skin.

PLATE XXXIV



Shows clouding upper third left pulmonary field. Diagnosis: Pneumonia consolidation left upper lobe.

PLATE XXXV



Miliary tuberculosis and consolidation right upper lobe.

pallor so well marked, for which there is no distinct group of symptoms. Occasionally the examination of the chest shows catarrhal symptoms and rhonchi such as accompany an ordinary bronchitis. There is an absence of bronchial breathing and no distinct evidence of dullness on percussion. Frequently these symptoms increase in severity. Cyanosis may accompany this condition and the circulation may be so poor as to show cold feet and hands. Death occasionally follows this condition. The clinical picture here given is the one that is frequently seen in that type of acute miliary tuberculosis running a malignant and very short course. In this condition the children appear very pale and lose weight. There is distinct anorexia which alternates with hyperorexia. Dyspeptic symptoms, such as vomiting and diarrhea, may alternate with constipation. Such children are usually very sensitive and inclined to be peevish and cry on the slightest provocation.

D'Espine's Sign.—This sign is of great importance in confirming the diagnosis of tuberculosis in its earliest stage. In children old enough to repeat the words "three thirty three" the echo heard of the last word is very significant, and should, when present, be regarded as supporting the diagnosis of tuberculosis.

D'Espine studied[1] a series of infants and children and noted that the whispered voice is not heard lower than the seventh cervical spine posteriorly.

If the lymph-nodes are enlarged and the patient whispers "three thirty three" then bronchophony is heard over the upper thoracic spine as well.

D'Espine's sign is best elicited[2] when the arms are folded well across the chest, the head sharply flexed, and the patient sitting erect. Firm pressure should be made with the stethoscope as patient repeats "three thirty three." When the sign is positive the final "e" of the last word persists for a moment like an echo after the phonation ceases. This postphonal quality is the significant feature. Young children can often repeat the "tree" more easily than the usual phrase. Occasionally the spoken voice or cough brings out the echoing quality more than the whisper.

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[1] D'Espine: Bulletin de l'Acad. de Méd., Paris, 1907.

[2] Stoll: Amer. Jour. Dis. of Children, Sept., 1915.

A study of the above symptoms will show that there are *no distinct typical symptoms* which can be laid *down as positively diagnostic.* It is for this reason that so many other diseases are confounded with miliary tuberculosis until the same has progressed considerably. When there is marked cachexia accompanying nurslings for which there is no distinct reason, and especially so if the fever accompanying the same is an intermittent type, then we should not forget the possibility of our dealing with a case of miliary tuberculosis.

An x-ray should be taken if tuberculosis is suspected. While many cases may be doubtful the clinical symptoms of cough, temperature, and faulty metabolism supported by an x-ray showing a lesion localized in the apex of the lung would support the diagnosis of an early tuberculosis. But one must not rely on the x-ray of the lungs as the only means of making a diagnosis.

The von Pirquet skin test is a most valuable aid, and should be performed as a routine measure.

TUBERCULIDES.

Papulo-necrotic tuberculides are round, flat papules, brownish in color. They have a central whitish depression and are usually covered with a small scale. They may occur on any part of the body. Their most frequent location is on the forearm, thighs, the external surfaces of the legs, and between the thighs. They sometimes occur on the face.

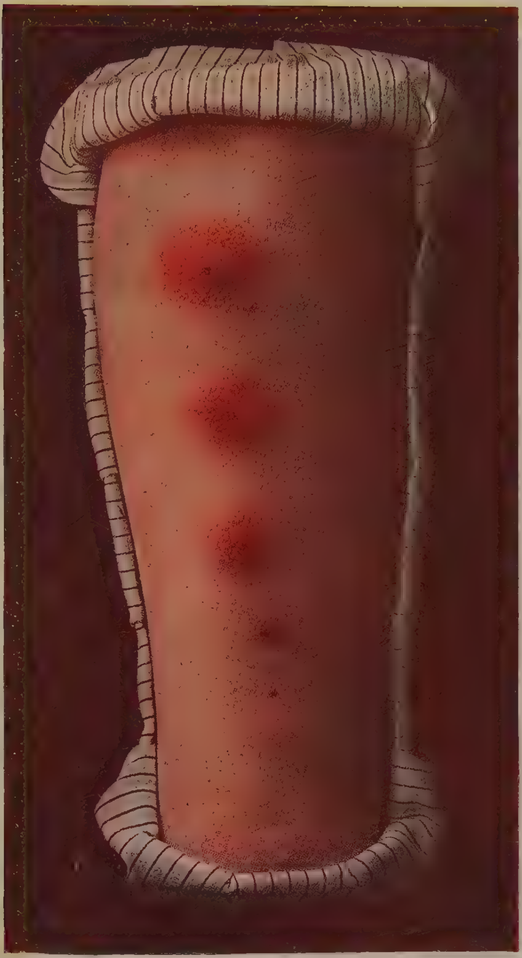
With the presence of the papulo-necrotic tuberculides aided by a Pirquet skin reaction we have one of the best means at our command of confirming the diagnosis of infantile tuberculosis. Even though the Pirquet reaction is negative, the presence of the papulo-necrotic tuberculides strongly favors a diagnosis of tuberculosis.

Hallopeau in 1896 at the Third International Dermatological Congress brought out the value of this lesion.

TUBERCULIN REACTION AN AID TO THE DIAGNOSIS OF LATENT FORMS OF TUBERCULOSIS.

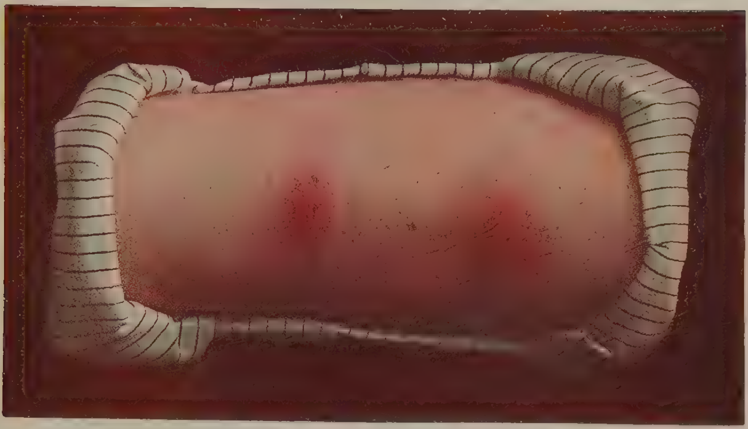
Pirquet found that by inoculating the skin with a minute quantity of old tuberculin a local inflammatory reaction is produced. There is no fever nor general systemic disturbance after such inoculation. With the older method of Koch fever followed

PLATE XXXVI

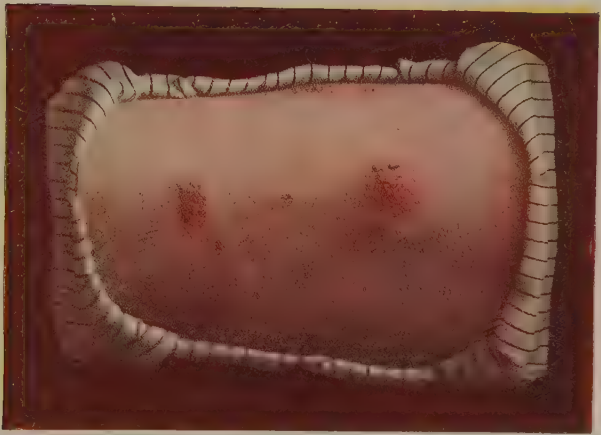


Cutaneous reaction showing the various results with concentrated and diluted tuberculin. Taken 48 hours after inoculation by *Dr. Henning*, at the clinic of Escherich.

PLATE XXXVII



Severe cutaneous reaction. Note the two places inoculated. The center is the control. (Escherich's Clinic.)



Scrofulous reaction. Two outer places inoculated. The center is the control. (Escherich's Clinic.)

each injection. The technic is as follows: Wash the arm with ether and scarify three small areas, but not enough to produce a bloody surface. Into two of the scarified areas inoculate (similar to vaccination) diluted tuberculin of the strength of one part tuberculin with three parts normal saline solution. Leave the third scarified area without inoculation as a control. After twenty-four, rarely later than forty-eight, hours a local inflammatory reaction, about 10 millimeters in width, surrounding the inoculated area, denotes a positive reaction. In the last stages of miliary tuberculosis and tuberculous meningitis no reaction follows. The ophthalmo reaction[1] is another method of diagnosis.

Morris R., 9 months old, was referred to the Infantorium by the Babies Welfare Federation. The mother had died. Father was at Otisville in the tuberculosis hospital. The infant did not gain in weight and did not seem to assimilate his food. There were no active signs of tuberculosis, the temperature was subnormal, the appetite was poor.

The diagnosis on admission was malnutrition caused by faulty metabolism. During the first week there was no gain in weight. The infant was restless and seemed ill at ease. The Pirquet test was positive. The x-ray of the chest showed no pulmonary abnormality. No active signs of tuberculosis were evident. The infant remained at the Infantorium fifty-one days during which period it gained in weight but the restlessness continued. During the fifth week the infant suddenly had a convulsion. A lumbar puncture was performed and examination of the fluid showed the presence of tubercle bacilli. The diagnosis of tuberculous meningitis was made. The infant died during the seventh week.

Prognosis.—The success attained during the last few years[2] in the treatment of tuberculosis proves the scientific progress made. Several years ago this disease was considered hopeless.

Modern physicians recognize the importance of treating the collapsed lung that has become so through unsanitary surroundings, in the light of cause and effect. The prognosis therefore will depend on the age of the patient, the stage of the disease in which treatment is commenced, and the will power of the patient. The vitality of children and their ability to pass through long periods of illness and finally recover should be remembered when the outcome of the case is considered. Severe forms of marasmus, with marked emaciation, apparently hopeless, finally recovered. I have also seen severe forms of apex tuberculosis in children that entirely recovered after proper hygienic and dietetic treatment was instituted.

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[1] Calmette advises using a 1/100 per cent. dilution of tuberculin dropped into the eye.

[2] Tuberculosis and How to Combat It, by S. A. Knopf, is well worth reading.

It is our duty to instruct parents and those in charge of children of the dangers, on the one hand, where treatment is neglected, and to picture to them, on the other hand, how successful other cases have been when the disease was properly handled.

Treatment.—In the treatment of tuberculosis the most important point to remember is that fresh air is the best lung disinfectant that we possess. No remedy will kill tubercle bacilli as quickly as sunshine and fresh air. This should be impressed on every family wherein a case of tuberculosis is found. The progress made in recent years by climatic treatment has demonstrated the fact that cavities in the lung will frequently heal under proper treatment. The open-air treatment has gained such a strong foothold that we do not encounter the same difficulties that we did years ago when recommending open windows night and day. The great bugbear of night air should be removed, because fresh air at night is equally as important as it is by day.

Heliotherapy.—Exposing the body to sun baths in addition to living out-of-doors, preferably at an altitude of several thousand feet, are recognized as the strongest modern therapeutic measures employed. Statistics show the great advantage of heliotherapy in mountainous regions; on the other hand, we have excellent results at the sea level in tuberculous children.[1]

Pulmonary Gymnastics.—Deep inspiration and expiration will oxygenate the lungs when regularly performed.

Deep breaths taken in the mountains on which there are pine-needle trees will do more toward expanding and impregnating diseased or collapsed portions of the lung than will the inhalation of a hundred times that quantity of pine-needle oil in the close, stuffy room when diffused from an atomizer. The hygienic treatment must not be confined to walking and breathing the pure air, but must be aided by tepid bathing and by stimulating the circulation of the blood by friction with a coarse Turkish towel. Sea salt can be added to the bath. When the feet or hands are cold they should be briskly rubbed until the blood circulates freely.

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[1] See report of John Winters Brannan on Results with Heliotherapy at the Seaside Hospital, Coney Island, 1913.

Dietetic Treatment.—Next to sunshine, fresh air, and pulmonary gymnastics comes nutrition. A child that is properly strengthened with milk, buttermilk, cocoa, eggs, cereals, cheese, green vegetables, fruits, meats, and meat broths will certainly be better able to recover than one that is underfed.

Milk if given should not be repeated oftener than once in four hours. The yolk of a fresh egg may be added just before feeding. When soup is given the yolk of a fresh egg may be added to it. I frequently give the yolks of eight or ten eggs in twenty-four hours if the gastric condition warrants the same. Strict attention must be paid to the bowels so that we do not overfeed and produce a dyspepsia by overfeeding. If milk is not well borne it may be peptonized.

Medicinal Treatment.—Codliver oil internally should be tried. If it is not well borne it can be used by external friction over the whole body, daily for ten or fifteen minutes. This is the so-called codliver oil bath. If codliver oil is not tolerated, butter should be given in large quantities. Codeine in $\frac{1}{10}$- to $\frac{1}{4}$-grain doses can be given, or heroin in $\frac{1}{50}$- to $\frac{1}{25}$-grain doses, three times a day, may be given to relieve cough. For the relief of the night sweats sulphate of atropine, $\frac{1}{150}$ to $\frac{1}{100}$ of a grain, three times a day, should be given. Toxic symptoms should always be looked for in the pupils when administering these drugs. A laxative dose of citrate of magnesia or calcined magnesia, 5 to 10 grains, several times a day, is useful.

I have had good results from 5- to 10-grain doses of gallic acid, when blood was expectorated, or fluidextract of hydrastis canadensis, 3 to 10 drops, several times a day, or hydrastinine hydrochlorate, $\frac{1}{100}$ grain, three times a day, may be tried. Tincture of iron, in 5- to 10- drop doses, is a good hemostatic; besides it is a valuable tonic. Stimulation is sometimes required. Gymnastics and exercise should be ordered. These must, however, be supervised, so that fatigue is avoided. Besides stimulating the circulation, exercise aids in the metabolism of food.

We must not consider a case cured when all active symptoms subside, but must persist with climatic treatment for many years, to avoid a reinfection.

Attention should be directed to the upper air passages and adenoids and tonsils must be removed if the slightest evidence of symptoms is noted.

To prevent the recurrence of tuberculous infection we must remove the patient from his former surroundings and keep him away from them after improvement is noted. There is danger of reinfection in taking a child from an out-door life of sunshine and fresh air back to an unsanitary home.

We should impress the family with the importance of continuing thorough oxygenation of the lungs night as well as day, and keeping the skin healthy by frequent tub baths. Out-door exercise should be advised, both for its stimulating effect on the circulation, as well as for its value in aiding food metabolism.

V.

ANAPHYLAXIS AND ALLERGY.

Anaphylaxis is an experimental state of hypersensitiveness produced in an animal or in an individual and resulting from the interaction of a precipitinogen or anaphylactogen, which is introduced into the body from without, and a precipitin, which is produced in the body by the action of the precipitinogen, resulting in the formation of a precipitate. Anaphylaxis is to be clearly differentiated from allergy. The latter is a natural inherent property of the cell protoplasm and cannot be produced experimentally. For example, anaphylaxis results from injections of sera, whereas allergy makes itself manifest by eating various food proteins or by inhaling them.

When we inject the first dose of horse serum we sensitize the guinea pig or rabbit, and the serum which was innocuous to the animal before the first injection was given has now made the animal so hypersensitive that the second injection of the same serum is not only very poisonous, but may result fatally. Such sensitive reaction is called anaphylaxis.

Richet demonstrated the fact that, although an animal could be sensitized to an injection of a non-toxic dose of serum, a second injection of a minimal quantity after a certain interval proved fatal. Later Arthus, using horse serum, obtained similar phonomena. Pirquet and Schick, working along similar lines, first definitely classified the symptom complex which develops after the injection of therapeutic sera as serum disease. They interpreted this as a reaction to a specific foreign protein. Briefly, the symptoms are as follows: Various skin manifestations of urticarial or erythema multiform type, fever, edema, and pain in the joints. They occur usually after a definite period of incubation of eight or twelve days.

When such individuals are re-injected the incubation period is reduced to a few hours. A local reaction, called the Arthus phenomenon, is present at the point of injection. The general symptoms are of short duration and sometimes accompanied by collapse. The sensitizing substance itself has been named allergen, which from the findings of Rosenau and Anderson is identical with the toxic substance of serum. It has been shown that the anaphylactic reaction is a specific one, *e.g.,* guinea pigs sensitized with horse serum do not react against other albuminous bodies, such as egg albumin or milk. It has been demonstrated that acquired susceptibility can be transmitted by heredity.

Nicolle and Otto have shown that a condition of passive anaphylaxis could be induced by treating a normal animal with the serum of an anaphylacticized animal. Although in animal experimentation in the vast majority of instances results are obtained by injection, Rosenau and Anderson succeeded by feeding animals in obtaining the reaction by way of the alimentary canal.

Wolff-Eisner believes that the phenomena of anaphylaxis are of central origin, so that individuals with an unstable vasomotor system are especially predisposed to the more severe forms of hypersensitiveness. Thus, asthma, urticaria, fibrinous bronchitis, and membranous enteritis are all related in their symptomatology. He alludes to vasomotor irritability, which causes eosinophile secretions, the fibrinous exudate, and the spastic condition as well.

The Prevention of Anaphylactic Shock.—According to Bedreska, if the serum to be injected is heated to 56° C., or 133° F., then not only can the phenomena be diminished, but, as a rule, averted.

According to Vaughn, if a preliminary injection of as little as 0.1 or 0.2 cubic centimeter of serum be made and no serious symptoms follow within two hours, the full dose can then be given.

Asthmatics are very sensitive. A hypodermic injection of atropine will be useful to prevent anaphylactic shock in a patient supposed to be unduly sensitive to the phenomena of anaphylaxis.

ALLERGY.

Allergy is a natural state of hypersensitiveness or idiosyncrasy existing in an individual. This idiosyncrasy may take any or all of these forms:—

(1) Food Idiosyncrasy.
(2) Drug Idiosyncrasy.
(3) Animal Idiosyncrasy.
(4) Hay Fever Idiosyncrasy.
(5) Asthma Idiosyncrasy.

(6) Poison Ivy Idiosyncrasy.
(7) Serum Disease Idiosyncrasy.

The clinical manifestations may be classified as follows:—

Ophthalmo—Respiratory—Acute Rhinitis, Asthma.
Cutaneous—Rash, Angioneurotic edema.
Gastrointestinal—Vomiting, diarrhea, abdominal pain.
General—Fever, shock, low blood pressure, leucopenia, sudden death.

Allergy is inherited in contradistinction to anaphylaxis which is transmitted only directly from mother to child.

The inherited idiosyncrasy is not necessarily the same in the offspring that it was in its progenitors. For example, a parent or relative may be sensitive to horse whereas the child may show an idiosyncrasy toward egg. Cooke and Vandeveer have recently shown that if both parents have an allergy that the child will show an allergy in 67 per cent. of cases; if only one parent has an allergy, then only 50 per cent. of the offspring will show the allergy and furthermore that if only a relative has an idiosyncrasy, then the niece or nephew or grandchild will show the idiosyncrasy in only 37 per cent. of the cases. Furthermore, where a higher percentage of the offspring is affected, the idiosyncrasy makes itself manifest earlier in life.

Recently tests have been devised to determine, if possible, to what protein an individual is hypersensitive.

In a series of 122 cases reported by O. M. Schloss, of New York, preference is given to the cutaneous test. This is termed the scratch test. Many vegetable proteins are difficult to obtain in a form soluble in physiological sodium chloride solution, but are soluble only in alkaline solvent. Such solutions cannot be used in intradermal tests.

Schloss[1] describes the condition of anti-anaphylaxis as met clinically: "Observations were conducted on 4 infants, 3 of whom were sensitive to egg and 1 to milk. Cutaneous tests were positive, and the ingestion of the egg or milk caused marked urticaria. Following the occurrence of symptoms, the cutaneous reaction disappeared and the foods could be ingested with no ill effect. After a period varying from twenty-seven to forty-five days, cutaneous sensitiveness returned and symptoms were caused by ingestion of the toxic foods."

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[1] Schloss, O. M.: A case of Allergy to Common Foods. Am. Jour. of Dis. of Children, vol. iii, pp. 341-362, June, 1912.

Allergy to Common Foods. Trans. Am. Ped. Soc., 37-62, 1915.

However, according to this author, it is doubtful if there is an anti-anaphylactic stage in all cases of allergy subsequent to production of symptoms.

Schloss believes it probable that the offending protein must be ingested in comparatively large amount and as shown in the case of one patient who developed a mild urticaria upon ingestion of a small amount of egg. With this patient the partaking of but $\frac{1}{20}$ of an egg white was sufficient to cause a few urticarial wheals. This amount was given the patient every other day for six days and produced each time a slight urticaria, and during this period the cutaneous reaction remained constantly positive to egg. Therefore no anti-anaphylactic state was set up by this small dosage, although the amount was sufficient to cause noticeable symptoms.

But, when the dose was, at this point, increased from $\frac{1}{3}$ of an egg white—severe urticaria developed and the cutaneous reaction simultaneously disappeared,—remaining negative for forty-six days and during which period the patient could eat $\frac{1}{3}$ of an egg white (the previously toxic dose) with no symptoms. However, upon the reappearance of the skin reaction the eating of egg white again caused urticaria.

Schloss is particular to explain that all of the patients used in his studies of the anti-anaphylactic state were those who developed urticaria only as symptomatic of their protein sensitization.

Discussing the origin of sensitization, he divides his idiosyncratic patients into two groups: 1. Inherited; 2. Acquired.

Satisfactory histories were obtained in 80 cases and of these a considerable majority was shown to be allergic by inheritance. The minority apparently acquired its sensitization and it will be recalled that Schloss has previously explained how infants may acquire sensitization through the gastroenteric tract when the mucous membrane is inflamed or irritated.

Clinical Types of Allergy.—In the hyperacute type with urticaria, asthma and symptoms of shock, some particular food is readily incriminated by the parents or the patient himself. Little of the food is eaten, since the infant vomits immediately.

Relative to bronchial asthma, Schloss states it is unnecessary to go into details, since the association of allergy with bronchial asthma is now a matter of common knowledge, adding "the very careful and painstaking work of Walker has shown that the allergy may be due to the proteins of food, pollens, epidermis of animals and bacteria." The experience of Schloss with bronchial asthma though relatively small is nevertheless stated to have been "entirely in accord" with that of Walker.

Relative to eczema the author finds that a considerable proportion of food idiosyncratics have or did have eczema during infancy and also finds that a large proportion of young children who develop bronchial asthma had eczema when infants and in many, a well marked family history of eczema exists.

Of 53 patients under 16 months of age, 40 reacted cutaneously to food proteins. Of these 13 reacted to not more than three proteins, whereas the other 27 reacted to more than three foods.

It is important to note that 34 of these cases reacted to egg white even though they had never eaten egg. Obviously the egg was not causative of the existing eczema—yet to learn if the reaction signified an inborn idiosyncrasy and should be regarded as a "danger signal"—a small amount of egg was given to 11 of these patients, resulting in definite symptoms in all.

To cows' milk on which their diet was based, 36 patients gave positive reactions and this seemed to indicate a likely cause of the eczema. But—and owing to the difficulty of providing artificially fed infants with proper nourishment—on a milk free regimen—dietetic experiments, with milk protein eliminated, were limited to 6 patients—who were given protein free milk (lactose and mineral salts), washed butter and soy bean protein. In twenty-four hours the eczema had markedly improved in each case and in three days had practically disappeared. The diet disagreed in other ways, causing vomiting and diarrhea, and observations were therefore discontinued. Relative to the disappearance of eczema after the elimination of the milk, Schloss quotes Blackfan as having had similar experience.

Other than 53 cases just quoted there were 24 cases of eczema over 16 months of age and of these, 10 gave positive reactions to skin tests.

Certain infants develop immediately acute gastroenteric disturbances in association with urticaria and angioneurotic edema when given cows' milk. They regularly react to milk protein by the skin test and the symptoms are pronounced as of doubtless allergic origin.

In a second group of this type, the symptoms are less acute and only appear after several days of milk ingestion. Such cases seldom react positively when the skin test is used.

This condition may be due to a disordered digestion or to bacterial activity in the intestinal tract, but Schloss records several observations as suggesting protein sensitization. He reports 5 cases unable to take raw cows' milk who could take milk in which the protein had been more or less changed by boiling or evaporation.

Certain cyclic disturbances characterized by recurrent attacks of vomiting, diarrhea and fever and appearing at intervals of two weeks to three months—are to the author suggestive of allergic origin. In a foot note he asserts that they are often due to focal infections—especially of the tonsils.

Treatment.—The obvious procedure of treating the patient is by simple elimination of the toxic food or foods, although this is asserted to be impossible in marked cases of multiple sensitization.

The toxic food, particularly milk or egg, when eliminated as such must not appear in other prepared dishes. Some patients will gradually establish a tolerance to such foods as milk and egg, *i.e.*, "recover spontaneously," but not all.

Treatment by hypodermic injection of the toxic protein is stated to accomplish desensitization as demonstrated by the following evidence: Desensitization was attempted by this method with 5 patients sensitive to egg. Two unimproved cases disappeared from observation before completion of treatment, but 3 became "completely immune."

Immunization by Feeding.—Schloss reports 12 patients immunized by feeding. The process is relatively simple, but slow and tedious since it requires from three to six months. It is stated to be especially adapted to egg and milk—protein being administered in capsule form, and starting with a dosage of 2 to 5 milligrams—and graduating up until there are given within twenty-four hours 15 to 30 grams of the protein.

If the patients are too young to swallow capsules the protein can be fed in solution. In such case $\frac{1}{20}$ of a drop of milk should be the initial dose. One-fifth drop of milk proved sufficient to cause reaction in one case, for it must be remembered that by this method the protein comes in direct contact with the buccal and pharyngeal mucosa. In one case pronounced swelling of the tongue and lips was caused by the administration of one drop of milk in a teaspoonful of water.

VI.

FEVER AND HYDROTHERAPY.

The origin of fever is still debatable. While some observers believe there is no evidence supporting the existence of heat centers, other observers such as Aronsohn and Sachs found that traumatism or irritation of the corpus striatum resulted in a rise of temperature.

The usual causes of fever are toxins, ferments and waste products absorbed in the lymphatics. Septic fever such as is found in chronic pulmonary tuberculosis caused by a constant absorption of toxins from the tubercle bacillus must be carefully considered in the light of therapeutics. Such cases should never be given antipyretic drugs owing to their depressant action. But fever should be reduced by means of sponging, tub bathing and similar hydrotherapeutic measures. In acute febrile infections such as the exanthemata in which it is necessary to conserve as much vitality as possible the reduction of fever should always take place by means of hydrotherapy. A high fever can be reduced by means of a warm tub bath aided by warm blankets until diaphoresis is produced.

When we wish to avoid a shock to the central nervous system then a warm bath is far more pleasant and effectual in reducing temperature than a cool tub bath.

Hydrotherapy is especially indicated in the treatment of pneumonia, acute meningitis, acute toxic and septic conditions, hyperpyrexia, disturbances of the central nervous system such as convulsions, twitching, and insomnia, in metabolic disturbances, and in atonic constipation.

There is no therapeutic agent that will reduce fever as rapidly, and with less cardiac depression than cool water.

To avoid shock a child can be placed in a tepid bath (temperature 90° F.) for several minutes. In febrile affections, where the toxin affects the central nervous system, producing insomnia, twitching and restlessness, a reaction will frequently be noted after the first bath. This reaction is a soothing, quieting influence in addition to the reduction of fever.

In lobar pneumonia where a temperature of 105° or 106° F. exists a tub bath given at 100° F. for three minutes will reduce the temperature. I have seen a temperature reduced from 3 to 4 degrees and the child fall asleep in one-half hour after a tepid tub bath has been given. If the bath produces chilling of the surface or cyanosis then gentle friction during the tubbing will restore the circulation. When marked depression exists from continued high fever, tub bathing should be omitted.

Wrapping the infant in warm blankets for at least fifteen to thirty minutes after the bath will produce diaphoresis. This is a good method of reducing fever, it stimulates diuresis and eliminates toxic impurities through the skin. Certain precautions are necessary if a weak pulse exists. In such a case a dose of 1/100 grain of strychnine should be given, or if the kidneys are inactive 1/6 to 1/4 grain caffein sodium benzoate may be given immediately before the tub bath.

In the acute exanthematous diseases such as scarlet fever or measles, when high fever exists, tub bathing is indicated. Delirium due to toxic retention can be greatly benefited by resorting to tub bathing. When carefully carried out there is no danger to the child. The old idea of chilling the surface or never using water in acute febrile exanthemata has long been abandoned. Experience teaches us that the emunctories of the body should remain active and that the skin should throw off as much poison as possible, and this can best be accomplished by means of warm tub baths. Restlessness, delirium, and especially insomnia, are greatly benefited by warm baths. The bath has a soothing effect on the central nervous system and induces sleep because the system gets rid of a large quantity of toxin by means of the bath.

In older children with poor appetites and cold extremities in which nervousness and hypersensitiveness exist nothing will replace a cold shower or bath. To stimulate an appetite or restore a poor circulation the cold tub or the tepid followed by a cold shower is almost specific.

For the relief of insomnia with dreaming and excitement such as talking in the sleep, a warm bath at night followed by a cold shower in the morning is very soothing and is a marked vasomotor toner. For nervous manifestations such as choreic twitching involving the face, and twitching of the body, no medication can equal the effect of the bath, but it must be continued for several weeks if a good effect is to be expected. Properly given the bath should be of short duration.

In metabolic disturbances a cold shower over the spine and chest for one minute, followed by brisk friction or general massage will stimulate metabolism. This is especially indicated in rachitic infants having flabby muscles, sluggish stools, dry skin and when a poor appetite exists. If the circulation of the extremities is poor we can immerse the feet in warm water during the cold shower of the upper portion of the body. To be successful with this treatment we must be firm and insist on continuing such treatment for several months before results will be apparent. The tub bath or shower is best given in the morning before breakfast.

Hardening Infants.—To harden an infant and prevent chilling of the body so that it is not susceptible to rapid changes of weather, the cold tub or shower is advised.

Atonic Constipation.—To relieve constipation due to atony of the intestine, nothing can replace cold water. Cold irrigations of the rectum and colon using 1 quart of running tap water, followed by a cold spray or shower over the lumbar region and the abdomen, this in turn followed by massage, will aid coprostasis. Immediate results must not be expected. Such treatment without the use of drugs must be given for weeks and sometimes months until our object is attained. The reader is referred to the article on Constipation for dietetic suggestions in addition to hydrotherapy.

VII.

BACTERIAL VACCINES.

The vaccine treatment of disease in children has many advocates. There are very many instances in which specific results may be obtained; on the other hand, we should not be disappointed when we meet with failures.

How to Procure an Autogenous Vaccine.—Clean the surface of the skin with alcohol or tincture of iodine. Make a small incision with a sterile bistoury into the furuncle and remove 1 drop of pus, to inoculate the surface of a blood-serum culture tube. Send to a laboratory to be placed in an incubator. From thirty-six to forty-eight hours' time is required to have a vaccine made.

Stock Vaccine.—If too remote from a laboratory, a stock vaccine of the staphylococcus variety may be used with excellent results.

Local infections, as well as general systemic infections with fever, do not contraindicate the use of these vaccines. They may be injected regardless of the temperature. Surgical treatment, and general systemic treatment of the bowels, kidneys, etc., should be continued just as though no vaccine had been used.

Streptococcus infections from the pleural cavity, as in empyema, or from the middle ear in acute otitis have been treated with vaccines.

The consensus of opinion found amongst competent clinical observers[1] is that the streptococcus vaccine has not the specific virtues, nor does the vaccine give the same benefit, obtained from the staphylococcus vaccine.

An injection of 50,000,000 to 500,000,000 dead bacteria is usually given. Of all vaccine therapy, the most brilliant results have been obtained with autogenous vaccines or stock vaccine of staphylococci; hence, in those diseases which owe their origin to a staphylococcus, vaccines should be used.

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[1] HOWLAND and HOOBLER: Archives of Pediatrics, Sept., 1910.

In chronic suppurative processes in which subnormal conditions prevail, vaccine therapy will stimulate phagocytosis and thus aid in restoring normal conditions.

In multiple furunculosis, in acne, and in otitis media due to the staphylococcus, vaccine should be used. In post-operative empyema with low vitality and tendency to run a long course, vaccine therapy is indicated. In suppuration of the antrum of Highmore, or in recurring styes caused by staphylococci, vaccine therapy should be used.

An injection of 50,000,000 bacteria constitutes the initial dose. The part is cleansed by tincture of iodine, and the injection given subcutaneously. Another injection of 50,000,000 bacteria should be given after three to five days, and if no improvement is noted at the end of ten days, then a third injection of 100,000,000 bacteria should be given.

Gonococcus Vaccine.—Injections of 50,000,000 to 100,000,000 bacteria of the gonococcus vaccine have been given by me daily until ten injections were given. No systemic reaction followed. The discharge lessened in some cases, it disappeared in others. The gonococcus however persisted.

Typhoid Vaccine.—An injection of 25,000,000 typhoid bacilli may be given to a child, and repeated in one week, unless a severe reaction is noted. If fever occurs, wait ten days to two weeks before giving the second injection. A third injection of 50,000,000 bacteria should be given ten days after the reaction following the second injection has subsided.

Pertussis.—I have had only fair results with the vaccine made from cultures of the Bordet-Gengou bacillus, by the Health Department of New York City. As a prophylactic three subcutaneous injections are usually given, one every third day. Children, 500 million, 1000 million and 2000 million; adults, 1000 million, 2000 million and 3000 million.

A local reaction may occur and is without significance, disappearing in twenty-four hours. A general reaction, which is rare, would indicate that the intervals between injections should be lengthened and dose more gradually increased.

Erysipelas Vaccine.—My results with vaccine treatment in erysipelas are excellent. I have seen a severe erysipelas improve after an injection of 50,000,000 bacteria the first day, 75,000,000 the second day, and 100,000,000 the third day. In profound toxemia with temperature ranging between 103° and 105° F., I have injected from 50,000,000 to 100,000,000 bacteria of the erysipelas vaccine in an infant 1 year old.[1] The dose was repeated every other day. Five doses in all were given.

Streptococcus Tonsillitis.—Give an injection of 50,000,000 bacteria. If no reaction follows, repeat the dose on the following day. If no improvement is noted, give 100,000,000 bacteria on the third day.

Rabies Vaccine.—The Pasteur treatment has now been simplified and can be administered at home by simple vaccine injections. When a child has been bitten by a dog, no time should be lost, but the treatment immediately begun. The daily dose for injection is contained in an ampule. The treatment should be continued for twenty-one days.

The New York Health Department sends out treatment by mail to physicians for their own patients. Full directions are sent in the mailing case. One-fourth of 1 per cent. of carbolic acid is added to the emulsion prepared as above for the first three days' treatment, 20 per cent. glycerine is added to all other emulsions. The carbolic and glycerine are added as preservatives and are omitted when the vaccine is administered to patients at the laboratory.

The Hygienic Laboratory at Washington also sends treatments by mail and a half-dozen manufacturing firms have followed suit. The results from the treatments sent seem to be equally as good as those from the treatments administered at the laboratory.

Vaccine Treatment of Pneumonia.—Literature records many cases of pneumonia in which marked improvement followed one or more injections of pneumococcus vaccine. My own experience with the vaccine has been good. I have used the heterogeneous variety, although in many cases an autogenous vaccine may be preferred. To procure an autogenous vaccine there are several difficulties encountered: First, the difficulty of procuring sputum from a child. Second, the time lost in waiting for a blood culture to grow, and then the preparation of a vaccine from the blood culture. This usually takes several days. When it is important to have an immediate effect, the stock vaccine should be used.

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[1] See clinical case in article on Erysipelas.

In the sputum there may be found the pneumococcus and the streptococcus. Frequently the streptococcus, staphylococcus, and influenza bacillus are found. Because of this mixed infection, the pure pneumococcus vaccine alone does not exert the specific influence that we might expect from it.

During the winter of 1914 I had occasion to see two unusually severe types of pneumonia. In one case an infant 13 months old received an injection of 1 cubic centimeter of the mixed influenza, pneumococcus, and streptococcus vaccine. The disease undoubtedly was cut short; the temperature dropped from 105° F. to normal in three days. The physical signs gradually disappeared. Convalescence was undoubtedly hastened by the use of the vaccine.

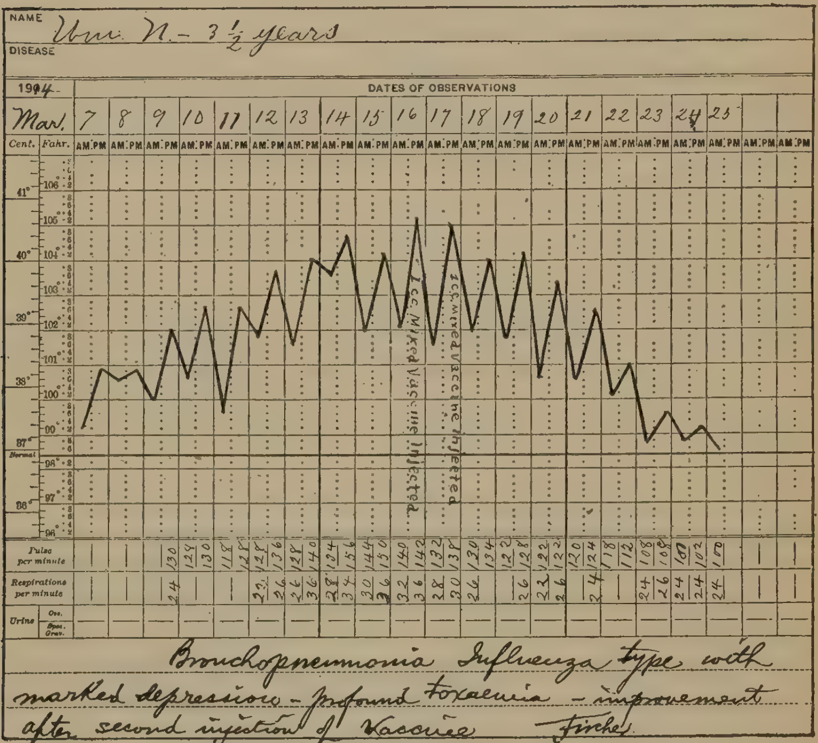

Fig. 146.—Temperature chart, case II.

A second child, 3½ years old, began with a severe influenza affecting the nose and throat, and follicular tonsillitis. The inflammatory condition extended and a bronchopneumonia was discovered seven days after the onset. In this case an injection of 1 cubic centimeter of the mixed pneumococcus, streptococcus, and influenza bacillus was given. As no distinct improvement was noted, a second injection was given, twenty-four hours later, after which decided improvement was noted. The disease terminated by lysis. The child recovered. (See temperature chart, Fig. 146.)

Vaccine treatment is especially indicated when fever is prolonged and resistance is poor. A marked leucocytosis usually follows these injections, thus proving that more resistance is given to the patient by such injection.

Influenza Vaccine.—The injection of 50 million bacilli of influenza attenuated with the pneumococcus, the streptococcus, and the micrococcus catarrhalis, given in intervals of three days is a very excellent prophylactic. These injections are accompanied by a very slight febrile reaction. In very young children one-half the dose should be given.

The vaccine gives more reserve to the body (usually produces a leucocytosis) and thereby offers greater resistance to the systemic infection. My own experience with this vaccine has been very good.

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